

HEARING ON THE MERITS

SOAH DOCKET NO. 582-07-2673

TCEQ DOCKET NO. 2007-0204-WDW

TRANSCRIPT OF PROCEEDINGS BEFORE THE
STATE OFFICE OF ADMINISTRATIVE HEARINGS
(TEXAS COMMISSION ON ENVIRONMENTAL QUALITY)

AUSTIN, TEXAS

APPLICATION OF TEXCOM GULF)
DISPOSAL, LLC, FOR TEXAS) SOAH DOCKET NO.
COMMISSION ON ENVIRONMENTAL) 582-07-2673
QUALITY COMMISSION UNDERGROUND) TCEQ DOCKET NO.
INJECTION CONTROL PERMIT NOS.) 2007-0204-WDW
WDW410, WDW411, WDW412 AND WDW413)

APPLICATION OF TEXCOM GULF)
DISPOSAL, LLC, FOR TEXAS) SOAH DOCKET NO.
COMMISSION ON ENVIRONMENTAL) 582-07-2674
QUALITY COMMISSION INDUSTRIAL) TCEQ DOCKET NO.
SOLID WASTE PERMIT NO. 87758) 2007-0362-IHW

HEARING ON THE MERITS
MONDAY, DECEMBER 17, 2007

BE IT REMEMBERED THAT at 9:01 a.m., on
Monday, the 17th day of December 2007, the
above-entitled matter came on for hearing at the State
Office of Administrative Hearings, William P.
Clements, Jr., Building, 300 West 15th Street, Room
407D, Austin, Texas before THOMAS WALSTON AND
CATHERINE EGAN, Administrative Law Judges, and the
following proceedings were reported by Lou Ray, a
Certified Shorthand Reporter of:

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HEARING ON THE MERITS

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<p style="text-align: right;">Page 851</p> <p>1 PROCEEDINGS 2 MONDAY, DECEMBER 17, 2007 3 (9:01 a.m.) 4 (TexCom Exhibit No. 72 marked) 5 JUDGE WALSTON: We'll go on the record. 6 It's Monday, December 17th, 2007, and this is a 7 resumption of the hearing on the merits in SOAH Docket 8 Nos. 582-07-2673 and 2674, the Application of TexCom 9 Gulf Disposal, L.L.C., for underground injection 10 control permits and for an industrial solid waste 11 permit. 12 Just for the record, the location has 13 been changed. We're now holding a hearing at the SOAH 14 hearing facilities in Austin, Texas. 15 Are there any preliminary matters that 16 we need to take up? 17 MR. RILEY: No, Your Honor. 18 JUDGE WALSTON: Okay. 19 MR. WALKER: Your Honor, there is a 20 preliminary matter. The applicant has provided us -- 21 MR. RILEY: I'm sorry, Mr. Walker, I'm 22 having trouble hearing you. 23 JUDGE WALSTON: Yeah, you can stay 24 seated, and you really need to talk in the microphones 25 in this room. It's hard to hear.</p>	<p style="text-align: right;">Page 853</p> <p>1 disadvantage. 2 MR. RILEY: Well, it was intended to 3 place Dr. Collier at a disadvantage, so I'm glad we 4 accomplished that goal. What it is, is a review of 5 Dr. Collier's work done by Dr. Langhus and the back-up 6 material that Dr. Collier cited. So it's nothing more 7 than what Dr. Collier has offered to this body in his 8 prefiled testimony, looking at the back-up documents 9 that he purports support his diagrams and maps and a 10 digest of each one of those segments. 11 And it will all become clear -- this is 12 cross-examination material and it was composed just 13 yesterday by Mr. Lee and Dr. Langhus going through 14 each one of the purported faults that Dr. Collier has 15 placed on a map and put into evidence as Aligned 16 Protestant 1P. And the intention is to go through 17 with Dr. Collier each one of his lines on that map, 18 and that's the nature of cross-examination. 19 So I'm not sure how Dr. Collier is 20 disadvantaged if indeed he was accurate in putting 21 together his exhibit. Then he should have no 22 difficulty at all citing to the source material we'll 23 ask him about. 24 JUDGE WALSTON: Well, why don't we 25 proceed, and if it's something that Dr. Collier says,</p>
<p style="text-align: right;">Page 852</p> <p>1 MR. WALKER: The applicant this morning, 2 Your Honor, has provided additional disclosures, which 3 if I understand correctly, would be information that 4 has been reviewed by Dr. Langhus. Is that right, 5 Mr. Riley? 6 MR. RILEY: No, it's actually 7 information that Dr. Langhus compiled yesterday. 8 MR. WALKER: This information has been 9 provided to us this morning, Your Honor, which 10 obviously Dr. Collier, who is about to testify, has 11 not had an opportunity to review yet. 12 It is a substantial bit of information 13 that the applicant is, I presume, intending to 14 cross-examine Dr. Collier with this morning based upon 15 their expert's review of the information. And, of 16 course, it is information, as I understand, that -- I 17 suspect the applicant will say was essentially part of 18 that information that we disclosed to them the day 19 after Dr. Collier's -- or at the time of his 20 deposition and then provided copies the day after his 21 deposition, which I believe was the 6th of December. 22 It places Dr. Collier in a position of 23 essentially today having to review and prepare 24 information that Dr. Langhus has asserted this 25 morning, and I think that places Dr. Collier at a</p>	<p style="text-align: right;">Page 854</p> <p>1 "I need some time to review this," then we may take a 2 break and let him review it. But we'll proceed and 3 see how it goes. 4 MR. WALKER: I will point out that on 5 the face of the disclosure, Your Honor, there is a 6 reference that Dr. Langhus has reviewed or prepared 7 the attached documents in anticipation of his 8 testimony. That's an erroneous assertion. This 9 information was not prepared by Dr. Langhus in 10 anticipation of his testimony. He's already 11 testified. 12 MR. RILEY: It's in anticipation of his 13 rebuttal testimony. If that's a clarification you 14 need, Mr. Walker, then we can certainly make it here 15 on the record. 16 MR. WALKER: All right. Thank you, Your 17 Honor. 18 JUDGE WALSTON: Anything else on a 19 preliminary matter? 20 MR. WALKER: Nothing else. 21 JUDGE WALSTON: Okay. If Dr. Collier 22 will step up to the witness stand? 23 Will you raise your right hand? 24 (Witness sworn) 25 JUDGE WALSTON: Be seated, and state</p>

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<p style="text-align: right;">Page 855</p> <p>1 your full name for the record. 2 WITNESS COLLIER: Hughbert Arnold 3 Collier. 4 JUDGE WALSTON: Dr. Collier, you're 5 doing a good job. Keep it up trying to talk directly 6 into the microphone if you can there. They're not 7 very good unless you're almost right on top of it. 8 WITNESS COLLIER: All right. 9 MR. WALKER: May I proceed, Your Honor? 10 JUDGE WALSTON: Yes. 11 PRESENTATION ON BEHALF OF 12 THE ALIGNED PROTESTANTS 13 HUGHBERT A. COLLIER, 14 having been duly sworn, testified as follows: 15 DIRECT EXAMINATION 16 BY MR. WALKER: 17 Q Dr. Collier, have you been retained in this 18 contested hearing to provide expert testimony? 19 A Yes, I have. 20 Q And are you a doctor of philosophy in the 21 discipline of hydrogeology? 22 A Yes. 23 Q Have you given pre-filed testimony in this 24 cause? 25 A Yes.</p>	<p style="text-align: right;">Page 857</p> <p>1 MR. RILEY: I guess the answer to 2 question would be "no," if it's not complete? 3 WITNESS COLLIER: Well, no, my answer 4 stays the same because all throughout this Geomap maps 5 are public record. You know, they're available to the 6 public, if you purchase them. 7 MR. RILEY: So then you don't need to 8 change that answer? 9 WITNESS COLLIER: I guess not. 10 MR. RILEY: Okay. 11 Q (By Mr. Walker) Anything else on Page 28, 12 Dr. Collier? 13 A That's everything on Page 28. 14 Q Was there a correction on Page 5? 15 A On Page 28, Line 16 -- 16 Q I'm sorry. 17 A -- "compilation of faults identified in 18 public records and by Geomap Company." 19 Q Okay. Is there a correction on Page 5? 20 A Yes. Page 5, Line 9 and 10, it should read, 21 "I have given depositions eight times or more and one 22 of these at the Railroad Commission." 23 JUDGE WALSTON: Say that again now. 24 WITNESS COLLIER: The phrase "at the 25 Texas Railroad Commission" should be after "I have</p>
<p style="text-align: right;">Page 856</p> <p>1 Q At this time, Dr. Collier, do you have any 2 corrections to your prefiled testimony? 3 A Yes. 4 Q On Page 28, Line 3 -- 5 MR. RILEY: Could we have a minute while 6 we get to that page? 7 I'm there. Thank you. 8 JUDGE WALSTON: Okay. 9 A It should state "compilation of faults 10 identified in public records and Geomap structure maps 11 and drafted by." 12 Q Anything else on that page, Dr. Collier? 13 A Line 11 should state "through 1-M and the 14 maps from Geomap Company." 15 Q All right. Anything else on that page? 16 A Line 12 should state, "Is this document a 17 true and correct compilation of the public records and 18 Geomap Company information?" 19 Q All right. 20 A Line 16 -- 21 MR. RILEY: I'm sorry, the witness is 22 correcting a question. Is that -- instead of 23 correcting an answer, he was correcting a question he 24 was asked. 25 JUDGE WALSTON: I guess so.</p>	<p style="text-align: right;">Page 858</p> <p>1 given depositions eight times or more, one of these at 2 the Railroad Commission." 3 Q (By Mr. Walker) Dr. Collier, any other 4 corrections to your testimony? 5 A On Exhibit 1P in the legend -- I believe it's 6 the last item identified in the legend. 7 JUDGE EGAN: Is it 1P or 1T? 8 WITNESS COLLIER: "P" as in Paul. 9 JUDGE EGAN: Okay. Thank you. 10 A I think it presently states, "The completion 11 data and water map from January 1st, 1944," and the 12 source is from the Texas Railroad Commission files. 13 So that's in the legend, the bottom line of the 14 legend, just add to the last line "from the Texas 15 Railroad Commission files." 16 Q (By Mr. Walker) Dr. Collier, any other 17 corrections to your testimony? 18 A None. 19 Q With those corrections, Dr. Collier, do you 20 adopt your prefiled testimony and the accompanying 21 exhibits as if you were testifying in person? 22 A I do. 23 MR. WALKER: At this time, Your Honor, 24 the Aligned Protestants would offer into evidence the 25 prefiled testimony of Dr. Hughbert Collier as Exhibit</p>

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<p style="text-align: right;">Page 859</p> <p>1 1, additionally Exhibits 1A, through 1Q; and then 2 additionally Exhibits 1R through 1V, as in Victor. 3 And those exhibits, 1R through 1V, are the exhibits 4 sealed under the protective order. Let the record 5 please reflect that these exhibits are being tendered 6 to the court reporter, two copies of each, as well as 7 the testimony. 8 MR. RILEY: And while that's being done, 9 I just have a procedural question, I suppose. When I 10 cross-examine on the matters that are subject to the 11 protective order and under seal in the record, how 12 would like me to handle that? Would you like me to -- 13 I don't know that the protective order requires us to 14 do anything regarding the folks in attendance, and 15 they're -- I guess they're not under -- they're not 16 necessarily subject to the protective order, so I'm 17 asking for clarification on how you would like me to 18 handle that, Judges? 19 JUDGE WALSTON: When you get to a point 20 we're going to go into a matter that's contained in 21 the exhibits that are sealed -- you'll have to refresh 22 my memory what the protective order states. I assume 23 we would need to exclude people who are not covered by 24 the protective order from the room. 25 MR. RILEY: That's typically what's</p>	<p style="text-align: right;">Page 861</p> <p>1 bring it up and we'll see if there is someone who is 2 not covered by the protective order in attendance and 3 we'll excuse those persons. 4 MS. GOSS: Your Honor? 5 JUDGE WALSTON: Yes. 6 MS. GOSS: The ED needs some 7 clarification on these exhibits. We have a Bates 8 numbers AP-220, 223, 224 and 227, and could you let us 9 know which ones of those are 1R, et cetera? 10 MR. WALKER: I'm confused by that 11 numbering. I'm not certain -- 12 JUDGE WALSTON: Are those part of the 13 confidential exhibits? 14 MS. GOSS: Yes, he just -- pardon me. 15 Mr. Walker just got 1R through 1V admitted, and I'm 16 trying to determine which are which. 17 JUDGE WALSTON: Okay. 18 MR. WALKER: R, S and T, for the record, 19 are the P2 Solutions; Exhibits U and V are the Geomap 20 exhibits. 21 JUDGE EGAN: R, S and T are what? 22 MR. WALKER: R, S and T are the exhibits 23 from P2 Solutions -- 24 JUDGE EGAN: Okay. 25 MR. WALKER: -- U and V are from Geomap</p>
<p style="text-align: right;">Page 860</p> <p>1 done. I don't know if that's necessary in this case 2 since the information is provided by the Aligned 3 Protestants, Montgomery County and City of Conroe. I 4 don't know if that's something they would require. 5 Typically, when it's business confidential information 6 in these hearings, it is necessary to actually clear 7 the room of folks who are not subject to the 8 protective order. So I will leave it to those -- to 9 the Intervenor to explain how they would like to 10 handle it. 11 MR. WALKER: In response to that, Your 12 Honor, the protective order states that the release of 13 the materials is prohibited to anyone who is not a 14 party to the litigation or representative of a party, 15 a consultant or expert witness working with or 16 retained by a party, or a TCEQ Commissioner, judge, or 17 other individual who may be called upon to evaluate 18 TexCom's applications that are subject to these 19 proceedings. 20 So I suppose, if I can summarize that, 21 parties, experts, TCEQ representatives, a 22 representative of a party, those would be admissible 23 individuals to hear the -- or to be present. Anyone 24 else would apparently need to be excused. 25 JUDGE WALSTON: When we get to that,</p>	<p style="text-align: right;">Page 862</p> <p>1 Company. 2 JUDGE EGAN: Okay. 3 JUDGE WALSTON: And refresh my memory, 4 were there any objections to the testimony of 5 Dr. Collier that were made or sustained? 6 MR. WALKER: None that were sustained, 7 Your Honor. 8 JUDGE WALSTON: I didn't think there 9 were. 10 Okay. Then objections have previously 11 been ruled upon and Aligned Protestants Exhibits 1, 1A 12 through 1Q and 1R through 1V are admitted. And we'll 13 just note for the record that 1R through V are sealed. 14 (AP Exhibit Nos. 1 and 1A through 1V 15 admitted) 16 MR. WALKER: Thank you, Your Honor. 17 With that, the Aligned Protestants will pass the 18 witness for cross-examination. 19 JUDGE WALSTON: Okay. Lone Star? 20 MR. HILL: No questions. 21 JUDGE WALSTON: Individual Protestants? 22 MR. FORSBERG: No questions, Your Honor. 23 JUDGE WALSTON: Public Interest Counsel? 24 MS. COLLINS: No questions. 25 JUDGE WALSTON: Okay. Applicant?</p>

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<p style="text-align: right;">Page 863</p> <p>1 MR. RILEY: I do have some questions, 2 yes. 3 CROSS-EXAMINATION 4 BY MR. RILEY: 5 Q Good morning, Dr. Collier. 6 A Good morning. 7 Q Are you able to hear me from where you're 8 seated? 9 A Yes. 10 Q All right. I'll try to keep my voice up. 11 I'm having a little trouble with my voice this 12 morning, but I will try to speak into the microphone 13 so that we can proceed with this examination. If you 14 have any trouble hearing me, please let me know and 15 I'll try to speak up even louder. 16 Firstly, Dr. Collier, I want to be 17 certain that I understood our discussion during your 18 deposition about your prior experience with injection 19 wells and injection disposal wells. And it's my 20 understanding that you have looked at only one -- 21 prior to the review of the TexCom permit application, 22 you had only reviewed one Class II Railroad Commission 23 application in any depth. Is that correct? 24 A Correct. 25 Q So you're -- the sum total of your experience</p>	<p style="text-align: right;">Page 865</p> <p>1 Q Okay. Did you read through the entire 2 application and all the exchanges with the TCEQ, the 3 correspondence typically referred to as the notice of 4 deficiency response? 5 A Yes. 6 Q If I understand your testimony correctly, you 7 are not qualified to give opinions or to conduct 8 reservoir modeling. Is that correct? 9 A Correct. 10 Q Is it fair to say, Doctor, that your 11 testimony concentrated -- excuse me, your preparation 12 and your testimony concentrated on identifying 13 additional artificial penetrations in the area of 14 review around the proposed TexCom facility, and 15 additional faults in the area of review as you saw 16 them? 17 A That was a major part of what I looked at. 18 Q Tell me all the parts of your review and what 19 you did. 20 A In addition to those two parts, I reviewed 21 all of the Section 5, which includes the local and 22 regional hydrogeology and geology; looked at the parts 23 of the application that require the applicant to 24 inventory all wells, including water wells, within the 25 area of review and then within a one-mile radius of</p>
<p style="text-align: right;">Page 864</p> <p>1 in disposal well review or review of applications for 2 disposal wells, either at the Railroad Commission or 3 the TCEQ is one application that you reviewed for a 4 matter before the Railroad Commission? 5 A Correct. 6 Q And again, that was a Class II well. Is that 7 correct? 8 A Correct. 9 Q Is it fair to conclude then that you have 10 never reviewed an application to the TCEQ for a Class 11 I disposal well? 12 A Correct. 13 Q What portions of the TexCom application did 14 you review as part of your engagement by Montgomery 15 County and the City of Conroe and in preparation for 16 your testimony here this morning? 17 A My testimony -- my review and examination 18 concentrated on Section 5, Section 7 and Section 8. 19 Q Did you review any other portions of the 20 application? 21 A I read through some of it. 22 Q Can you be more specific, sir? 23 A I read through the application, but my 24 review -- the work that I did was in Sections 5, 7 and 25 8.</p>	<p style="text-align: right;">Page 866</p> <p>1 the property. I looked at the parameters that were 2 used in the reservoir modeling. 3 Q What parameters did you look at regarding the 4 reservoir modeling? 5 A I looked at the porosity, the permeability, 6 the -- the aerial extent that the model is based on. 7 Q I'm sorry, I didn't understand the last 8 portion of your answer. You looked at the aerial 9 extent -- 10 A The aerial extent. 11 Q Of what? 12 A That the model is based on. The model is 13 based on some aerial extent geographic area. 14 Q Have you ever run a reservoir model? 15 A No. 16 Q Okay. And how did you review the reservoir 17 modeling without having prior knowledge of reservoir 18 modeling or being able to conduct reservoir modeling? 19 A Well, the applicant is required to list in 20 the application all that -- the parameters that are 21 input into the model. Those parameters are geological 22 parameters that are based upon the study that was done 23 or not done in Section 5, which is the geology. So 24 you have to do the geology first in order to have the 25 proper parameters to run in the model.</p>

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<p style="text-align: right;">Page 867</p> <p>1 Q And what parameters, if any, do you have 2 difficulty with or do you disagree with that were 3 input into the reservoir modeling? 4 A The aerial extent for the model not having 5 any -- aerial extent for no boundaries, and then the 6 permeability from the Fall-off test is different from 7 the permeability that was the core analysis that was 8 used in the model. 9 Q All right. Let's talk about the last part of 10 your answer. First you have a disagreement with the 11 permeability that was used in the TexCom modeling. Am 12 I understanding you correctly? 13 A Correct. 14 Q And why is that, sir? 15 A Well, they used 500 millidarcies in the 16 model, and the Fall-off test gives a calculation of -- 17 I think it was 81 -- 80-something millidarcies. 18 Q Have you ever conducted a Fall-off test, sir? 19 A No. 20 Q Do you know what it involves? 21 A Yeah, I know what it involves. 22 Q What does it involve? 23 A It involves injecting at some rate -- I think 24 they injected at, I believe, it was three 25 barrels-per-minute, and injecting -- pressuring up an</p>	<p style="text-align: right;">Page 869</p> <p>1 Q Other than regurgitating what's in the 2 application already regarding the Fall-off test, do 3 you have any ability to interpret Fall-off test data? 4 A No. 5 Q And you mentioned a core analysis that's also 6 in the permit application. Do you know what a core 7 analysis is? 8 A Yes. 9 Q What is it, sir? 10 A It's a sample of the formation that is 11 removed during the drilling process, submitted to a 12 lab, and then various petrophysical parameters are 13 measured on it. 14 Q Would one of those petrophysical parameters 15 measured include permeability? 16 A Yes. 17 Q Were the core samples from the WDW-315 18 evaluated in a laboratory? 19 A Yes. 20 Q And what were the results of those tests 21 regarding permeability? 22 A I believe the permeability was listed as 23 approximately 500 millidarcies. 24 Q Is it actually true, sir, that it's listed in 25 a range?</p>
<p style="text-align: right;">Page 868</p> <p>1 interval for a time and then measuring the pressure as 2 it declines over a period of time after you conclude 3 injecting. 4 Q Have you ever interpreted or reviewed 5 Fall-off data tests or data from a Fall-off test prior 6 to this case? 7 A No. 8 Q Were you able to review the test data for the 9 Fall-off test that you're referring to? 10 A I did not. 11 Q Where did you -- how did you then identify a 12 difference in permeability as between the model inputs 13 and what you believe was the Fall-off test result? 14 A It's mentioned in the records. 15 Q In the application, is it not, sir? 16 A Yes. 17 Q Do you understand the zone that was 18 perforated in the original well WDW-315 and how many 19 feet of perforation were done in that test? 20 A Yes. 21 Q And what was the -- what was the number of 22 feet in WW -- WDW-315 for the Fall-off test? 23 A It was a little over 100 feet. 24 Q Does 90 sound correct, sir? 25 A It may -- it may be.</p>	<p style="text-align: right;">Page 870</p> <p>1 A It may well be. 2 Q Okay. Do you know what the range is, sir? 3 A No. 4 Q How much time did you spend reviewing the 5 core sampling data in the TexCom application? 6 A Not a lot of time. 7 Q Do you know where the core sample was taken 8 in terms of the wellbore and the perforated interval 9 that is -- was evaluated in the Fall-off test? 10 A I don't know the exact depth. 11 Q Do you know where it is in relationship to 12 the perforated interval that was tested in the 13 Fall-off test? 14 A Not without going back and looking to see the 15 exact depth. 16 Q And yet you disagree with the use of that -- 17 let's assume you're correct that it's approximately 18 500 millidarcies -- you disagree with using that 19 permeability in reservoir modeling. Is that correct? 20 A Well, that value can be used, but when you 21 have additional data such as a Fall-off test, it's 22 what's called a matter of scale. And you have to look 23 and decide -- if you have a discrepancy -- which of 24 the two are more representative. And you see in the 25 application they obviously believe that the zone that</p>

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<p style="text-align: right;">Page 871</p> <p>1 they had perforated is too tight for production 2 because the application states that they're going to 3 abandon that zone and move up the wellbore and 4 perforate an upper interval. 5 Q What did you mean when you said "too tight 6 for production"? I don't understand that term. 7 A Well, too tight for injection. 8 Q Well, the -- do you understand that the 9 TexCom application proposes to perforate different 10 intervals within the injection zone? 11 A Yes. 12 Q All right. So tell me your understanding of 13 the relevance of the Fall-off test given that 14 knowledge, that TexCom believes that there are more 15 permeable sands available in the well than were 16 originally perforated? 17 A Well, the reservoir modeling that had been 18 done to present has to be based upon data that's 19 available. 20 Q And what are you basing that statement on, 21 sir? 22 A If you're going to -- the reservoir modeling 23 includes porosity, permeability. Since you have a 24 Fall-off test, that's the data that you have at the 25 time to input into the model.</p>	<p style="text-align: right;">Page 873</p> <p>1 characterization. 2 Q Well, I understand that's your -- I guess 3 your statement of qualification to make such a 4 statement of what is required in this case, but I'm 5 trying to understand since you've never -- other than 6 the one occasion you've already testified about 7 regarding a Class II well at the Railroad 8 Commission -- you've never done this work for 9 injection wells. Is that correct? 10 A Correct. 11 Q Do you understand the regulatory process 12 following permitting of an injection well? 13 A Somewhat. 14 Q All right. Do you understand that if indeed 15 the Fall-off test originally done is correct and the 16 permeability of the new interval perforated by TexCom 17 is 81 millidarcies, that additional considerations are 18 required before waste could ever be injected? 19 A Correct. 20 Q So if indeed you are correct -- although 21 obviously the application believes otherwise, or 22 applicant believes otherwise -- that the permeability 23 is 81 millidarcies, then the TCEQ would require the 24 applicant to make additional considerations before any 25 waste could be injected. Do you understand that?</p>
<p style="text-align: right;">Page 872</p> <p>1 Q Well, what statement -- you've never handled 2 a Class II Well application, correct? 3 A Correct. 4 Q And you've never performed reservoir 5 modeling, you've never reviewed Fall-off test data, 6 and yet you're stating under oath on the record that 7 you must use that Fall-off test data in this 8 application. Is that your testimony? 9 A Yes, because what I have done is a lot of 10 core analysis and integration of core analysis with a 11 wireline log, with pumping tests, with reservoir 12 characterization. And it's the same principles for 13 that work that it is in this case. 14 Q What is "that work" that you -- you so 15 vaguely refer to "that work," what work are you 16 referring to? 17 A Any type of work in which you have core 18 analysis, in which you have wireline logs, in which 19 you have aquifer tests and you integrate the data to 20 characterize the reservoir. And I've done those type 21 of projects in Florida and in Texas in various 22 aquifers -- reservoirs in Texas and other states as 23 well. So the principles are all the same whether it's 24 a Class I injection well, a Class II injection well, 25 or whether it's just what we call reservoir or aquifer</p>	<p style="text-align: right;">Page 874</p> <p>1 A Correct. 2 Q What is your opinion as to the permeability 3 of the lower Cockfield sands? 4 A It is low permeability. 5 Q You're going to have to be more specific, 6 sir. What in millidarcies or darcies is the 7 permeability of the lower Cockfield sand? 8 A Well, you can't put an exact number on it. 9 You look at the logs. You see that the sands are 10 thin -- relatively thin. There's a lot of shale 11 interbedded with them. So, you know, is it 80 12 millidarcies? If it's going to have some variation 13 without some type of analysis such as additional core 14 analysis, or additional type of pressure testing, you 15 can't put an exact number on it. But the applicant in 16 the application -- 17 Q That's not my question, sir. I asked you -- 18 and I object to you giving an answer other than what 19 I'm asking you, and I'd ask that the Judges instruct 20 you to confine your answer to the question. 21 A Well, I am confining my answer to the 22 question -- 23 Q I asked you if you had an opinion as to the 24 permeability of the lower Cockfield? 25 A Yes. And the applicant in the application</p>

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<p style="text-align: right;">Page 875</p> <p>1 talks about the low permeability of the sand. There 2 are no numbers that are given, but due to the 3 depositional nature of the sand, it's recognized and 4 you can see that -- I see that in the data -- that the 5 permeabilities are low. Exactly how low, I can't -- I 6 can't give you an exact number. But obviously the 7 applicant thinks they're low enough that they're not 8 going to inject into those sands. 9 Q Well, do you understand what -- what interval 10 the application or the applicant proposes to inject 11 into? 12 A Yes. 13 Q And what is that? 14 A They were -- they want to move up and 15 reperforate about -- I think it's some 6,040 roughly 16 to about 6180. 17 Q Does that correlate with a geologic stratum? 18 A Yes. 19 Q What is it? 20 A That's still fairly low in the Cockfield. 21 And the applicant in their application talk about 22 that -- 23 Q I asked you does it correlate to a geologic 24 stratum in your opinion? 25 A The 60 -- 6040 to 6180 is the lower part of</p>	<p style="text-align: right;">Page 877</p> <p>1 Q Correct me if I'm wrong, Dr. Collier, the 2 upper Cockfield runs from a depth of 5134 to 5629. Is 3 that correct or incorrect? 4 A That's correct. 5 Q And the middle Cockfield runs from a depth of 6 5629 to 6045. Is that correct or incorrect? 7 A Well, on the exhibit that I'm looking at, 8 they're identifying the top of the lower Cockfield as 9 6291. There may have been a later revision of this. 10 Q I don't know what you're looking at, sir. 11 A This is the applicant's figure V.b.1.3, dated 12 8-1-05. 13 Q And what is your testimony then regarding the 14 thickness and the depth of the middle Cockfield? 15 A Well, I'm going off what the applicant -- 16 Q Do you have a separate opinion other than 17 what's in the application, Dr. Collier? 18 A No, not as to the top of the lower Cockfield. 19 Q So you're reading from the applicant's -- 20 your interpretation of the application. Is that 21 correct? 22 A No, it's not my interpretation from the 23 application. 24 Q Okay. You've referenced one exhibit in the 25 application. Do you know what it is you're</p>
<p style="text-align: right;">Page 876</p> <p>1 the middle Cockfield. 2 Q Is that your understanding? 3 A That's from the applicant's Page 73, figure 4 Roman Numeral V.b.1.3 -- 5 Q And so -- 6 A It's -- yeah, that's right. 7 Q So your understanding of the proposed 8 injection interval in the application is the lower 9 part of the middle Cockfield? 10 A They originally were putting it in the lower 11 Cockfield, and then they mention that they're going to 12 have to go ahead and move up higher, which would be 13 the lower part of the middle Cockfield. The original 14 interval is the lower Cockfield. 15 Q Do you not understand, sir, that they're 16 moving up within the lower Cockfield higher than the 17 original perforated zone, but not above the shale 18 later between the lower and the middle Cockfield? Do 19 you not understand that? 20 A That's not what I read in the application. 21 Q Do you not understand that, sir? 22 A Apparently I don't. 23 Q How thick is the lower Cockfield, sir? 24 A The lower Cockfield is identified by the 25 applicant as being 100 -- about 110 feet thick.</p>	<p style="text-align: right;">Page 878</p> <p>1 referencing? 2 A I've told you what it is twice. 3 Q You've told me the letter. Do you know what 4 it is? 5 A It is the Cockfield formation in WDW-315 well 6 illustrated with open hole wireline logs. 7 Q Are there other boring logs in the 8 application? 9 A Yes, they have copies of their logs. 10 Q And do you have -- have you reviewed those 11 other logs? 12 A I don't have them here before me. 13 Q That's not my question, sir. You said you 14 reviewed the application. My question is did you 15 review those borrowing logs before your testimony here 16 this morning? 17 A I have looked at those logs. 18 Q Have you reviewed them sufficiently to offer 19 an opinion as to the depth of the various stratum 20 thereof concerned in this proceeding? 21 A I accept the applicant's designations. 22 Q So if the applicant designated the middle 23 Cockfield of a depth of 5629 to 6045, you have no 24 basis to disagree with that designation? 25 A I have no problem with that.</p>

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<p style="text-align: right;">Page 879</p> <p>1 Q And you have no problem, I assume then, with 2 the application's designation of the lower Cockfield 3 as 6045 to 6390? 4 A No. 5 Q Can you tell me the -- starting from the 6 surface -- the various stratum that underlie the 7 proposed TexCom site? 8 A Yes. 9 Q If you're referring to something, please let 10 us know what you're referring to. 11 A I'll refer to the -- the applicant has a 12 strat column on Page V-18, and I accept their 13 stratigraphic column. They call it a hydrologic strat 14 column for the TexCom WDW-315 well. 15 Q Could you read, starting from the surface, 16 the various stratum that underlie the TexCom site? 17 JUDGE WALSTON: Let me ask you: Is this 18 one of the exhibits attached to your testimony as 19 well? 20 WITNESS COLLIER: No. 21 JUDGE WALSTON: No. 22 WITNESS COLLIER: This is in the 23 application. This is Figure V.b.2.1. 24 MR. RILEY: Would it be helpful if we 25 identified that figure in the applications and then</p>	<p style="text-align: right;">Page 881</p> <p>1 Section 5 -- 2 WITNESS COLLIER: Yes. 3 JUDGE EGAN: -- Page 78 of 315 -- 4 MR. RILEY: That's what we have as ours 5 also. 6 WITNESS COLLIER: Yes, that's right. 7 JUDGE EGAN: I believe it's exhibit -- 8 MR. RILEY: That's correct. 9 Q (By Mr. Riley) Doctor, this particular 10 hydrologic strat column does not go all the way down 11 to the Cockfield shale. Is that correct? 12 A Correct. 13 Q Are you able to tell me the stratum that 14 underlie the TexCom site all the way down to the 15 Cockfield shale? 16 A Yes. You start on Page 78. I accept their 17 designations on Page 78. And then if you back up a 18 couple of pages, on Page 74 they show then the Jackson 19 formation underlying the Catahoula down to 5180, and 20 then the Cockfield formation from 5180 on down to the 21 lower confining zone of the Cockfield. 22 Q All right. And you have no reason to 23 disagree with those characterizations in the 24 application or the identification of the stratum in 25 the application?</p>
<p style="text-align: right;">Page 880</p> <p>1 point you to a page? 2 JUDGE EGAN: Thank you. 3 MR. RILEY: Thank you. 4 WITNESS COLLIER: In the original 5 application of 8-1-05 this is Page 78 of 314. 6 MR. WILLIAMS: Do you know what volume? 7 MS. GOSS: Do you have volume numbers? 8 WITNESS COLLIER: I'm working on it. 9 This is Volume 1. 10 MR. RILEY: The volume number -- at 11 least I believe what the witness may be looking at -- 12 is Volume 2 -- 13 WITNESS COLLIER: Your application has 14 Volume 1. 15 MR. RILEY: So these are exhibits, but 16 if you have a copy of the exhibit and you can focus us 17 more narrowly, I'd appreciate that. Is it a volume 18 that is an exhibit in the case or is it a volume -- 19 WITNESS COLLIER: It's your application. 20 JUDGE EGAN: It appears to be Volume 2 21 in our volumes. They've been marked differently from 22 the exhibits. 23 WITNESS COLLIER: Mine is marked as 24 Volume 1. 25 JUDGE EGAN: And it is Section -- under</p>	<p style="text-align: right;">Page 882</p> <p>1 A No. 2 Q I'd like to show you what has been previously 3 marked as TexCom Exhibit 72, and perhaps that will be 4 easier to work with for this series of question. 5 Dr. Collier, could you take a minute and 6 review Exhibit 72 and compare it to the pages that you 7 just pointed us to in the application and make sure 8 that the stratum are listed in the correct order and 9 properly under the -- as they are on this exhibit, 10 Exhibit 72? 11 A (No response) 12 Q Again, all I'm asking for, Doctor, is in 13 relative location, not anything beyond -- I'm not 14 asking you to agree with or verify anything other than 15 the order of stratum below the site? 16 A I agree. 17 Q Okay. And have you had sufficient time to 18 review it and compare it to the application that you 19 just adopted? 20 A Yes. 21 Q So am I correct in saying that at least as it 22 pertains to the order of the stratum below the 23 proposed TexCom site, Exhibit 72 is accurate? 24 A Correct. 25 MR. RILEY: At this time I offer into</p>

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<p style="text-align: right;">Page 883</p> <p>1 the record TexCom Exhibit 72.</p> <p>2 JUDGE WALSTON: Any objection?</p> <p>3 Hearing none, TexCom Exhibit 72 is</p> <p>4 admitted.</p> <p>5 (TexCom Exhibit No. 72 admitted)</p> <p>6 Q (By Mr. Riley) Doctor, I think this will be</p> <p>7 easier to work with than the application in the</p> <p>8 binder, so let's look at Exhibit 72 together. And the</p> <p>9 question I have of you is would -- what is a horizon?</p> <p>10 When one is talking in geologic terms and is looking</p> <p>11 at a horizon, what would one be describing?</p> <p>12 A Well, I think most people would be talking</p> <p>13 about a formation. It would be an identifiable unit</p> <p>14 in the subsurface that has unique enough</p> <p>15 characteristics to be separated from the strata above</p> <p>16 it and below it.</p> <p>17 Q All right. And is it fair to say then, at</p> <p>18 least in what seems to be accepted geologic terms,</p> <p>19 that each of these various stratum are -- fit that</p> <p>20 qualification, they are different horizons?</p> <p>21 A That would be -- that's more a layman's term.</p> <p>22 That would be fine.</p> <p>23 Q Now, when one talks about mapping a horizon,</p> <p>24 what is one discussing in your understanding?</p> <p>25 A Well, mapping a horizon, you're -- you're</p>	<p style="text-align: right;">Page 885</p> <p>1 that are lowered into a borehole on a wireline to</p> <p>2 either measure naturally-occurring physical properties</p> <p>3 of the subsurface, or to induce various either</p> <p>4 electrical current or radioactive elements to measure</p> <p>5 the physical properties.</p> <p>6 Q Am I correct then what a wireline is doing --</p> <p>7 or someone who is engaged in using a wireline tool --</p> <p>8 is trying to evaluate the stratum in a wellbore?</p> <p>9 A Correct.</p> <p>10 Q As between wireline data and actual core</p> <p>11 samples, which would you consider more reliable for</p> <p>12 depicting the stratum in a particular wellbore?</p> <p>13 A Well, the absolute ground truth is core.</p> <p>14 Q I understand your answer to be that a core</p> <p>15 sample would be more reliable than a wireline</p> <p>16 evaluation?</p> <p>17 A For -- yes, for that particular interval that</p> <p>18 the core is taken, yes.</p> <p>19 Q So for that well. I'm not talking more</p> <p>20 generally than that. For that well, if you're doing a</p> <p>21 wireline versus evaluating a core, as a geologist I</p> <p>22 assume you'd rather have the core data itself?</p> <p>23 A Well, your question mixes up -- if you</p> <p>24 continuously cored the well or whatever interval</p> <p>25 you're in -- let's say in this case your injection --</p>
<p style="text-align: right;">Page 884</p> <p>1 mapping identifiable characteristic. Usually it is</p> <p>2 based upon wireline logs. So it could be a</p> <p>3 radioactive marker. It could be some other</p> <p>4 distinguishing characteristic, and you're preparing a</p> <p>5 subsurface map based upon that identifying</p> <p>6 characteristic.</p> <p>7 Q And is that a -- well, let me ask you a</p> <p>8 different question: Are most wells when they're</p> <p>9 drilled cored and evaluated by a geologist?</p> <p>10 A No.</p> <p>11 Q Why is that?</p> <p>12 A In the old days, they did. Nowadays</p> <p>13 relatively few wells are cored, mainly because of</p> <p>14 expense.</p> <p>15 Q Am I correct then in understanding wirelines</p> <p>16 and other types of marker evaluations are not done by</p> <p>17 evaluating -- by evaluating a core sample?</p> <p>18 A If they're available, they would be</p> <p>19 integrated with it. But since they're usually not</p> <p>20 available, then wireline logs are -- the correlations</p> <p>21 are made without cores, correct.</p> <p>22 Q Okay. So a wireline -- what is a wireline?</p> <p>23 Can you be more descriptive?</p> <p>24 A It's called wireline logs or you could just</p> <p>25 call it logging. It's -- they are different tools</p>	<p style="text-align: right;">Page 886</p> <p>1 if you continuously cored it, that is the absolute</p> <p>2 best data. If you only have one or two selected cores</p> <p>3 out of it, then your best data, as far as</p> <p>4 characterizing the well, as you've said, or the</p> <p>5 interval, that best data is going to be the wireline</p> <p>6 log.</p> <p>7 Q Okay. And I didn't mean to be misleading.</p> <p>8 I'm assuming in a hypothetical sense that when I've</p> <p>9 drilled a well, I've cored from the surface all the</p> <p>10 way down to the bottom or the total depth of the well</p> <p>11 and I have that core available. As between a core</p> <p>12 such as the one I just described and a wireline, am I</p> <p>13 correct that the core data is more reliable?</p> <p>14 A Yes.</p> <p>15 Q What other types of data or tools are used to</p> <p>16 evaluate the geologic stratum in a wellbore?</p> <p>17 A Well, sometimes you look at the cuttings of</p> <p>18 the well -- from the well --</p> <p>19 Q If you could explain what a cutting is so we</p> <p>20 all understand?</p> <p>21 A Well, as you're drilling the well, what</p> <p>22 you're drilling through has to be removed from the</p> <p>23 well. And those samples, which are called cuttings,</p> <p>24 are brought up to the surface and you can study them.</p> <p>25 You can look at various types of pressure testing,</p>

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<p style="text-align: right;">Page 887</p> <p>1 drill stem-test, any type of pressure testing of your 2 formation will give you some information about your 3 zone that you're studying. 4 Q Now, in trying to get a picture of what the 5 stratum are as one drills through them, we've already 6 discussed coring and wire logs, using -- excuse me, a 7 wireline -- using a wireline, am I looking for 8 something as a marker in the wellbore that gives me 9 a -- I guess a point of depth? Do you understand my 10 question? 11 A Well, you're looking at that plus a lot of 12 other things. You're measuring physical properties of 13 the rock as you raise that tool from the bottom up to 14 the top. It's a continuous measurement of these 15 various physical properties. 16 Q And what I'm trying to understand, Doctor -- 17 let's -- you used the term radioactive marker, and 18 what is a radioactive marker? 19 A Well, it's a -- it's a zone that has a high 20 enough radioactive signature, and if it is consistent 21 across an area, then it can be used as a marker and 22 you can map based on it. 23 Q Let me see if I understand. If I took a 24 hypothetical field and I did a number of different 25 well borings and I found at a certain depth -- or</p>	<p style="text-align: right;">Page 889</p> <p>1 Q Could it mean that the surface was uneven at 2 the time the radioactive marker was deposited? 3 A You could have that. 4 Q So if I had a hill -- let's say in geologic 5 time I had a hill that was a 25-foot hill -- or 6 variation; let's not call it a hill -- a variation in 7 a surface stratum or at the surface, and then whatever 8 event occurs that deposits a radiologic marker, and 9 then a couple million or whatever number, tens of 10 millions of years pass, could that hill or high point 11 on the surface show up as a different depth, then in 12 the hypothetical I was trying to construct -- say 13 there was a 25-foot difference between where I found 14 the radiological marker in one well and radiological 15 marker in another well, could that just be a variation 16 in surface topography at the time of deposition? 17 A Could be. 18 Q Without any further information, how would 19 you distinguish that variation in the radioactive 20 surface marker as between a variation at the time of 21 deposition or a variation because of movement or 22 faulting? 23 A You could look at the lithology above and 24 below your radioactive marker. And if you've got a 25 difference like that -- say a hill -- then chances are</p>
<p style="text-align: right;">Page 888</p> <p>1 approximately the same depth -- a radioactive marker 2 of the type you described. What I -- and I correlated 3 those between and among the wells that I have drilled, 4 then I'd be at least postulating that that's a point 5 in geologic history that is common to those wells. Am 6 I following along? 7 A Yes. 8 Q So I would map that in the sense of I -- if 9 it appeared deeper in one well than another well, I 10 could at least make some assumptions as to what the 11 stratum was like as between those wells. Am I making 12 sense? 13 A Correct. 14 Q All right. And just for clarification, let's 15 say I find a radioactive marker in one well at 16 100 feet deep, just to make it simple, and in another 17 well I find that radioactive marker that I believe are 18 the same geologic event or correlates to the same 19 geologic event that deposited the radioactive 20 material, and I find that at 200 feet, what does that 21 tell me, if anything, as between those two wells? 22 A If it is the same radioactive marker, it 23 means that there has been movement in the -- it means 24 that there is very probably been fault between those 25 two wells.</p>	<p style="text-align: right;">Page 890</p> <p>1 your fill material in your lower area might well be 2 different than the other one. So you would look at 3 the -- you would look at the log above and below your 4 radioactive marker to get an indication of that. 5 Q Okay. But is there a definitive way to 6 determine whether it was an undulation in the surface 7 at the time of deposition or it was a fault that 8 occurred at some subsequent time? 9 A You could perhaps use seismic to determine 10 whether or not it's a fault. 11 Q All right. The extent of offset -- do you 12 know what I mean when I use the term "offset"? 13 A Yes. 14 Q And what does that mean? 15 A If you take a fault plain and if you look at 16 a -- the same point, the same horizon, on each side of 17 the fault, the offset is how much vertical offset -- 18 or it could be lateral offset -- it's how much that 19 fault plane has moved. And generally it's a matter of 20 up or down. 21 Q And how does one, based on wireline logs or 22 anything other than a core sample, determine as 23 between two wells that something -- or radioactive 24 marker that shows no offset or zero foot offset -- how 25 does that indicate a fault, in your opinion?</p>

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<p style="text-align: right;">Page 891</p> <p>1 A If it has zero?</p> <p>2 Q Yes, sir.</p> <p>3 A If you have zero offset, then you would not</p> <p>4 be able to identify it on your wireline logs.</p> <p>5 Q Why would one conclude that a zero offset is</p> <p>6 a fault if -- based on wireline information? How</p> <p>7 would that happen?</p> <p>8 A They would have had to have had some other</p> <p>9 information such as pressure information and fluid</p> <p>10 levels.</p> <p>11 Q Can you classify faults into major and minor</p> <p>12 categories?</p> <p>13 A That's -- that's not done in the application.</p> <p>14 It's not done in TCEQ rules. And geologically -- I</p> <p>15 mean, there's -- you know, I guess theoretically you</p> <p>16 can do anything. It's not done in the application and</p> <p>17 it's not done especially in the TCEQ rules.</p> <p>18 Q Sir, are you an expert in the TCEQ rules?</p> <p>19 A I can read them.</p> <p>20 Q I understand that. Have you ever handled a</p> <p>21 Class I permit application previously?</p> <p>22 A No.</p> <p>23 Q So is it fair to say that other than reading</p> <p>24 them, you have no experience in the requirements of</p> <p>25 the TCEQ rules, do you?</p>	<p style="text-align: right;">Page 893</p> <p>1 Q On what occasion?</p> <p>2 A We've looked at faulting in the Floridan</p> <p>3 aquifer.</p> <p>4 Q Okay. So in Florida you've looked at</p> <p>5 faulting and you have used some criteria to</p> <p>6 distinguish in that matter between major and minor,</p> <p>7 correct?</p> <p>8 A No. I said we looked at faulting. We did</p> <p>9 not bother to distinguish between major and minor.</p> <p>10 Q Sir, I've asked you several times now and I'm</p> <p>11 going to try to hone in now, and I'd ask you, unless</p> <p>12 my question calls for something more than a "yes" or</p> <p>13 "no" I'd ask you to confine your answer to a "yes" or</p> <p>14 "no."</p> <p>15 Yes or no, you have in your prior work</p> <p>16 classified faults as major and minor?</p> <p>17 A Perhaps at some time. I don't recall any</p> <p>18 specific --</p> <p>19 Q A moment ago I asked you if you had ever in</p> <p>20 your work been called to classify faults as major and</p> <p>21 minor and you said yes. Now I'm asking to you recall</p> <p>22 those instances so we can establish some criteria and</p> <p>23 you say you don't recall them. Is that correct?</p> <p>24 A I don't recall an instance.</p> <p>25 Q Do you think it is possible and would be</p>
<p style="text-align: right;">Page 892</p> <p>1 A Correct.</p> <p>2 Q So let's stick to geology and your field of</p> <p>3 expertise. Do you -- or are you, as a geoscientist,</p> <p>4 able to distinguish between major and minor faults?</p> <p>5 A It depends upon whose definition -- you have</p> <p>6 to define what you mean by "major" and a "minor"</p> <p>7 fault.</p> <p>8 Q I'm asking you if you have ever in your</p> <p>9 career distinguished between major and minor faults?</p> <p>10 A Yes.</p> <p>11 Q All right. And what criteria did you use,</p> <p>12 sir?</p> <p>13 A It depends upon the project and the scale.</p> <p>14 Q Okay. Let's talk about the most recent</p> <p>15 project you worked on and that you were asked to</p> <p>16 identify major and minor faults. Can you recall that?</p> <p>17 A No, because generally, if we're looking for</p> <p>18 faults, we're looking for faults. We don't classify</p> <p>19 them as major or minor because in hydrogeology --</p> <p>20 Q Sir, I'm asking you if you recall that.</p> <p>21 That's all I asked you.</p> <p>22 A No.</p> <p>23 Q All right. You said that you've done it</p> <p>24 previously?</p> <p>25 A Yes.</p>	<p style="text-align: right;">Page 894</p> <p>1 useful in some situations to distinguish between major</p> <p>2 and minor faults?</p> <p>3 A In some situations.</p> <p>4 Q In what situations would you consider it to</p> <p>5 be helpful to make that -- to distinguish major and</p> <p>6 minor faults?</p> <p>7 A Well, if you're doing large scale regional</p> <p>8 work, you're looking at fault trends that go across</p> <p>9 counties or maybe go across for hundreds of miles,</p> <p>10 then you're looking at what people would normally call</p> <p>11 major faults. And then when you go out and -- that</p> <p>12 would be stuff you'd look at like on maybe aerial</p> <p>13 photography or long seismic lines.</p> <p>14 And then when you went out on a field</p> <p>15 work, you might find minor faults that are associated</p> <p>16 with those major fault zones. And those, depending</p> <p>17 upon the scale, may be -- you may see evidence in the</p> <p>18 field of anything from faulting down on a matter of a</p> <p>19 couple of inches up to feet or hundreds of feet, and</p> <p>20 major and minor would be relative depending upon the</p> <p>21 project.</p> <p>22 Q Okay. Let's talk about relative major and</p> <p>23 minor faulting. Is a fault that's a hundred -- has</p> <p>24 150 -- 100 to 150 feet of throw or offset, would you</p> <p>25 consider that to be a major fault?</p>

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<p style="text-align: right;">Page 895</p> <p>1 A It depends upon your context. I would say, 2 it would be a major fault. 3 Q And a fault that has, maybe, 20 feet of 4 offset, would you consider that to be a major or a 5 minor fault? 6 A Again, it depends upon your context and what 7 you're classifying your fault for. There are cases 8 where it could be still a major fault. 9 Q Okay. In this case, in the evaluation of 10 Exxon data, are you able to distinguish any categories 11 of faulting as between -- in the line that we've been 12 discussing between major and minor? 13 A No, there's no need to. 14 Q I understand your position on rules you've 15 only read once, sir, but I'm asking you if you can 16 give us, as a geoscientist or a geologist, any ability 17 to distinguish faults in this case? 18 A Distinguish faults as far as major or minor? 19 Q Yes, sir. 20 A No. 21 Q Then it's your opinion that all faults in 22 this case are a necessary consideration. Is that 23 correct? 24 A Yes. 25 Q And so even if there's a line drawn by some</p>	<p style="text-align: right;">Page 897</p> <p>1 I assume those circles are drawn on a 2.5 mile radius. 2 Is that correct? 3 A Yes. 4 Q And are the surface faults that you identify 5 in your prefiled testimony, as you just said, only one 6 of those faults, the Big Barn East Fault -- or a 7 portion of the Big Barn East Fault is in the area of 8 review, correct? 9 A Correct. 10 Q Why did you include the others? 11 A Because one of the things that the applicant 12 is charged with is you're not -- 13 Q Again, sir, I'm going to ask you, unless you 14 have some other experience in what TCEQ requires, for 15 you to explain the indication -- area of review, what 16 does that mean to you? 17 A The area of review is a two-and-a-half mile 18 radius for each of the proposed injection wells. 19 Q Yet many of the surface faults that you say 20 exist, based on cracks in pavement and what-not are 21 outside the area of review, correct? 22 A Yes. 23 Q And why did you include them? 24 A I started to explain that before you 25 interrupted me. We looked at what -- the area both</p>
<p style="text-align: right;">Page 896</p> <p>1 geologist at some time that shows 20 feet of offset in 2 a different horizon other than where the applicant is 3 proposing to inject, you still think that is necessary 4 for consideration? 5 A Yes. 6 Q Okay. Now, in your prefiled testimony you 7 photograph a number of events that you purport are 8 indications of surface faulting. Is that correct? 9 A Correct. 10 Q Which of those surface faults, as you've 11 characterized them, are in the area of review? 12 A There is one of them. 13 Q Which one? 14 A That's the Big Barn, a portion of the Big 15 Barn fault. 16 Q A portion of the Big Barn fault. Do you have 17 your prefiled testimony before you? 18 A Yes. We can refer to exhibit -- my Exhibit 19 O. 20 Q Your exhibit -- why don't we give everyone a 21 chance to get there. 22 A O. 23 Q Now, I see on Exhibit O several circles that 24 you've drawn around the proposed wells for TexCom 25 which give a little variation in the area of review.</p>	<p style="text-align: right;">Page 898</p> <p>1 within the area of review and outside of the area of 2 review to get the regional context. And as it's 3 stated in the rules, you're not limited to looking at 4 the area of review if you think it necessary. 5 Q If you think it necessary, sir? 6 A Yes. 7 Q If who thinks it's necessary? 8 A Well, if the applicant -- it's stated if it's 9 necessary to look beyond the area of review. And what 10 you see -- the reason I did was because you're in a 11 part of Texas where surface faulting is known to 12 occur. It's common knowledge within the geologic 13 community. 14 So we looked at both within the area of 15 review and outside of it. Part of the area of review 16 we could not drive some of the roads because they're 17 part of the Conroe field and they were not -- dirt 18 roads and not accessible to the public. Part of these 19 roads are not paved, so we drove both inside and 20 outside to get a feel and to see if there were even 21 surface faults visible in the area. 22 Q Sir, are you saying there aren't many roads 23 around Conroe and the proposed facility? 24 A That's not what I said. 25 Q Okay. What did you say?</p>

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<p style="text-align: right;">Page 899</p> <p>1 A I'll repeat what I said to you.</p> <p>2 Q I didn't ask you to repeat it. I asked</p> <p>3 you -- sir -- sir --</p> <p>4 JUDGE WALSTON: Well, don't argue. I</p> <p>5 mean, he answered the question and he's trying to</p> <p>6 answer it again.</p> <p>7 MR. RILEY: Okay. Well, let me</p> <p>8 rephrase. Thank you.</p> <p>9 Q (By Mr. Riley) What roads did you drive in</p> <p>10 the area of review?</p> <p>11 A We drove most of the paved roads within the</p> <p>12 area of review. But as I said, some of the roads are</p> <p>13 not paved. It doesn't do any good to look for surface</p> <p>14 faulting on unpaved roads. They don't show up. And</p> <p>15 then some of these roads, either paved or unpaved,</p> <p>16 were private roads within the Conroe field and we did</p> <p>17 not have access to them. So we did not drive those</p> <p>18 roads.</p> <p>19 Q So when I asked you what roads did you drive,</p> <p>20 your answer seems to go beyond my question, so I'm</p> <p>21 going to ask you again. If you could confine your</p> <p>22 answers to the scope of my question -- you'll have an</p> <p>23 opportunity if Mr. Walker decides to ask you questions</p> <p>24 as follow up. Can we agree on that from this point</p> <p>25 forward?</p>	<p style="text-align: right;">Page 901</p> <p>1 exists and to what extent it exists?</p> <p>2 A I answered that previously.</p> <p>3 Q And the answer is no?</p> <p>4 A No.</p> <p>5 Q Okay. Other than your contact with a single</p> <p>6 other geologist -- is that correct? You've had one</p> <p>7 contact with a geologist that you employed to assist</p> <p>8 you in this case, correct?</p> <p>9 A That's incorrect.</p> <p>10 Q All right. Please explain.</p> <p>11 A There were two geologists.</p> <p>12 Q Okay. One of the geologists that you</p> <p>13 reference in your deposition you actually retained to</p> <p>14 identify surface faults for you in the Conroe area,</p> <p>15 correct?</p> <p>16 A Correct.</p> <p>17 Q And what is that geologist's name?</p> <p>18 A That's Carl Newman (sic).</p> <p>19 Q Excuse me?</p> <p>20 JUDGE WALSTON: He couldn't hear you.</p> <p>21 A Carl Newman (sic)</p> <p>22 Q And as I understand it, you subcontracted</p> <p>23 with Carl Newman (sic) to get his information</p> <p>24 regarding his research -- not your research -- his</p> <p>25 research of surface faults in the area of review,</p>
<p style="text-align: right;">Page 900</p> <p>1 A Yes.</p> <p>2 Q Thank you. Could you find in your -- I</p> <p>3 believe it's Exhibit C -- the photograph that relates</p> <p>4 to the Big Barn East Fault? It's a series of</p> <p>5 photographs. It doesn't seem to have an independent</p> <p>6 page number.</p> <p>7 A It would be the fourth page under Exhibit C.</p> <p>8 Q All right.</p> <p>9 A At the top -- the upper-most photograph.</p> <p>10 Q Has this Big Barn East Fault been named or</p> <p>11 recognized in any publication, any geologic paper,</p> <p>12 anything other than your testimony in this case?</p> <p>13 A No publications that I know of.</p> <p>14 Q So the only place where the Big Barn East</p> <p>15 Fault exists is in this photograph and your testimony,</p> <p>16 correct?</p> <p>17 A No.</p> <p>18 Q Well, please explain.</p> <p>19 A There are some geologists in the Houston area</p> <p>20 who specialize in surface faulting, identification and</p> <p>21 delineation of surface faulting.</p> <p>22 Q But that's not you, is it, sir?</p> <p>23 A That's right.</p> <p>24 Q Sir, is there any publication by any of those</p> <p>25 geologists that indicate that the Big Barn Fault</p>	<p style="text-align: right;">Page 902</p> <p>1 correct?</p> <p>2 A That's only partially correct.</p> <p>3 Q Did you ask Carl Newman (sic) for his</p> <p>4 research regarding faults in the area of review?</p> <p>5 A Yes.</p> <p>6 Q And the only fault that Carl Newman gave you</p> <p>7 was the Big Barn East Fault. Is that your testimony?</p> <p>8 A No.</p> <p>9 Q In the area of review, sir?</p> <p>10 A Within the area of review, yes. But he did</p> <p>11 not give that to me. That's where your question is</p> <p>12 misleading. He would not give me his data. We went</p> <p>13 out and looked. He would not give me his maps, so we</p> <p>14 went out and drove the roads and did all the work</p> <p>15 again.</p> <p>16 Q So -- and as I understand your testimony in</p> <p>17 your deposition, Mr. Newman has specialized in -- or</p> <p>18 is much more knowledgeable of the region around</p> <p>19 Houston and the region around the proposed TexCom site</p> <p>20 than you are personally, correct?</p> <p>21 A Yes.</p> <p>22 Q And he would not give you the information he</p> <p>23 has regarding his evaluation of surface faulting?</p> <p>24 A He would not -- no, that's why we went out</p> <p>25 and looked at everything again.</p>

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MONDAY, DECEMBER 17, 2007

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<p style="text-align: right;">Page 903</p> <p>1 Q So he gave you tips as to where to look. Is 2 that correct? 3 A Correct. 4 Q And you identified the Big Barn East Fault. 5 Is that correct? 6 A Correct. 7 Q Is that the way Mr. -- or Dr. Newman, I 8 assume -- referred to it? 9 A Yes. 10 Q How did you define the extent of the Big Barn 11 East Fault? 12 A Well, the Big Barn East Fault is really seen 13 just where it cuts the highway there. 14 Q So on your map though it seems that you 15 certainly have drawn a line much greater than I'd say, 16 what, 20 feet through the roadway? 17 A Yes. 18 Q How did you determine the extent of the Big 19 Barn East Fault? 20 A We did that for purpose of identification. 21 Q So one should not look at your Exhibit O and 22 concluded that that fault actually is shown in the 23 area of the review. Is that correct? 24 A No, it's in the area of review when you look 25 at the circles.</p>	<p style="text-align: right;">Page 905</p> <p>1 Barn East Fault is 20 feet as best you can tell? 2 A Yes. 3 Q So the line that you've drawn on here is not 4 representative of the extent of the fault and may 5 indeed not be even inside the area of review, correct? 6 A It may not be, but it may be much longer than 7 what we've drawn. 8 Q Okay. But we're going to go with what you 9 know, sir, not what you think -- 10 A Yes. 11 Q Based on your information and your evaluation 12 of the Big Barn East Fault, the best you could say is 13 it extends 20 feet across the roadway and is evidenced 14 by the cracks that you show in your photograph? 15 A Yes. 16 Q Would that be true if I went through each of 17 the other faults on this map -- your surface faults -- 18 would it be true that the lines are not representative 19 of the actual extent of faulting or are drawn to -- 20 are not drawn to scale. Is that correct? 21 A Correct. 22 Q Let's talk about the depth of these surface 23 faults. I believe you told me in your deposition that 24 in your professional geologic opinion, these faults 25 extend from the surface of the ground down thousands</p>
<p style="text-align: right;">Page 904</p> <p>1 Q Well, that's what I'm asking. You said that 2 you only could tell the extent of the fault based on 3 the surface cracks in the road, correct? 4 A Yes. 5 Q And the surface cracks in the road -- let me 6 find the Big Barn East again. Is that Exhibit O that 7 you were looking at earlier? 8 A Yes. 9 Q What's the scale of this map? I don't see 10 it? 11 A It's bottom right-hand corner above the bar 12 scale. 13 Q Okay. The -- it seems as though about 14 half-inch equals half a mile, correct? 15 A Yes. 16 Q All right. How long would you say you've 17 drawn the line for the Big Barn East Fault? 18 A It's drawn as a half-mile or longer. 19 Q But I though I just understood you to say 20 that you could only determine the extent of the Big 21 Barn East Fault by the cracks in the payment that you 22 show in your picture and no further information 23 exists? 24 A Yes. 25 Q So it would seem that the extent of the Big</p>	<p style="text-align: right;">Page 906</p> <p>1 of feet into the Willcox formation. Is that your 2 opinion? 3 A Correct. 4 Q On what do you base that opinion, sir? 5 A I base it upon the fact that when you look at 6 other mapping that has been done in the field, you see 7 faulting at approximately 500 feet below the surface. 8 You see faulting in the lower part of the Jackson 9 formation at about 5,000 feet. You see faulting at 10 different intervals within the Cockfield, and then you 11 see deeper faulting on some regional maps. And when 12 you talk to the geologists who specialize in 13 identifying surface faults, if they're working a new 14 area -- 15 Q I'm going to object -- 16 A I'm answering the question -- 17 MR. RILEY: I'm going to object -- no, 18 I'm going to object because now you're about to 19 testify about what some other geologist who 20 specializes. That's not you. Is that correct? 21 A That's correct. 22 JUDGE WALSTON: I think your question, 23 though, was what does he base it on, and he is 24 testifying that's what -- 25 MR. RILEY: That's fair enough, Judge.</p>

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<p style="text-align: right;">Page 907</p> <p>1 Thank you.</p> <p>2 JUDGE WALSTON: It's not for the truth</p> <p>3 of the matter, but --</p> <p>4 MR. RILEY: I understand.</p> <p>5 JUDGE WALSTON: Go ahead.</p> <p>6 A These geologists who specialize in surface</p> <p>7 faulting, if they're working an area they have not</p> <p>8 worked before, one of the first things they will do is</p> <p>9 to go to some of these -- any subsurface maps they</p> <p>10 have available, even though they're on much deeper</p> <p>11 horizons, and they'll look and see if there's any</p> <p>12 faulting identified on the maps. And then they know</p> <p>13 at about what angle the faults normally are. So you</p> <p>14 can do your trigonometry, and if you're at, say, 8,000</p> <p>15 feet below the surface and you know the fault is maybe</p> <p>16 45 to, say, 60 degrees or so, you can project where</p> <p>17 you would see it at the surface.</p> <p>18 So one of their standard methods of</p> <p>19 operation, one of the things they do, is to project</p> <p>20 that deep fault to the surface, and then they go and</p> <p>21 look and see if they can find that fault on the</p> <p>22 surface. And quite -- not all the time, but quite</p> <p>23 often they do. And then they will also drive the</p> <p>24 roads in the area, look at the aerial photography, do</p> <p>25 all those types of things and see if you can find</p>	<p style="text-align: right;">Page 909</p> <p>1 They can be higher. But if you're alerted to faults</p> <p>2 in the subsurface, then you go up dip and it will be a</p> <p>3 swath, it will be a path, maybe a couple of thousand</p> <p>4 feet that you've got to look at and you'll look for</p> <p>5 any evidence. I can't give you an exact location of</p> <p>6 where that fault is going to be, sir.</p> <p>7 Q Well, sir, that's why I'm asking you. So</p> <p>8 then -- it would seem to me then, based on your</p> <p>9 testimony, that surface faults, to the extent that</p> <p>10 they are relevant at all, would only be after you did</p> <p>11 an evaluation to see whether or not, one, they exist</p> <p>12 in the subsurface and, two, whether they exist in the</p> <p>13 area of review. Because the surface fault in an area</p> <p>14 of review would certainly not be found in the</p> <p>15 subsurface in the same place, correct?</p> <p>16 A Correct.</p> <p>17 Q So showing surface faults in the area of</p> <p>18 review would not indicate faulting in the deep stratum</p> <p>19 in the area of review?</p> <p>20 A It depends upon where your surface fault was</p> <p>21 located.</p> <p>22 Q Well, and I'm following you, but if I take</p> <p>23 the surface fault and I do trigonometry at a 45-degree</p> <p>24 angle, let's say, what distance from the surface</p> <p>25 manifestation would I be before I found the subsurface</p>
<p style="text-align: right;">Page 908</p> <p>1 additional evidence of surface faulting.</p> <p>2 Q Doctor, did you do any of that work?</p> <p>3 A Do any of -- we looked at the -- we looked at</p> <p>4 the deeper horizons. We drove the roads to look for</p> <p>5 them, and we looked at the aerial photography.</p> <p>6 Q Sir, if I understood you correctly, that --</p> <p>7 you were making a motion with your arm indicating that</p> <p>8 faults occur at angles, correct?</p> <p>9 A Correct.</p> <p>10 Q Now, as I -- if I were a bird or, as we say,</p> <p>11 a bird's eye view looking down on a fault --</p> <p>12 correct --</p> <p>13 A All right.</p> <p>14 Q -- that, as you say, you find at the surface,</p> <p>15 if you do the trigonometry -- as you just said to the</p> <p>16 Judges -- where would that fault be located, say, at</p> <p>17 6,000 feet? Where would you find the deep fault that</p> <p>18 corresponds to the surface fault that you claim</p> <p>19 correlates in some instances?</p> <p>20 A It would depend upon the angle of the fault.</p> <p>21 Q All right. And what do you understand the</p> <p>22 angles of the faults to be in the Conroe area? Is</p> <p>23 there a common angle?</p> <p>24 A There's not a common angle. That's why I</p> <p>25 said they can be 45 degrees, they can be 60 degrees.</p>	<p style="text-align: right;">Page 910</p> <p>1 manifestation?</p> <p>2 A It depends upon -- I said depends on -- are</p> <p>3 you talking about a particular fault or --</p> <p>4 Q Well, I'm trying to understand what your</p> <p>5 testimony is regarding the surface faults. And you've</p> <p>6 just explained that you don't find them -- they're not</p> <p>7 perpendicular, right? There's no fault that occurs at</p> <p>8 a 90 degree angle, correct?</p> <p>9 A Well, there are -- there can be faults that</p> <p>10 are perpendicular. These are probably at some angle.</p> <p>11 Q Okay. So again, if I took your surface</p> <p>12 fault -- and is there a trend in terms of which side</p> <p>13 of the fault would be up thrown and which side would</p> <p>14 be down thrown?</p> <p>15 A Many of the faults are down thrown on the</p> <p>16 Gulf Coast side, but that is not always the case, and</p> <p>17 especially when you're looking on top of a salt dome</p> <p>18 there is not a -- you have to look at the -- each</p> <p>19 individual fault and see what's the down thrown side.</p> <p>20 Q Okay. Other than identifying surface faults,</p> <p>21 is there any relevance to the deep stratum that</p> <p>22 underlie the TexCom site that one could draw? I mean,</p> <p>23 in other words, is it your postulate that those</p> <p>24 surface faults indicate faulting in the deep stratum,</p> <p>25 specifically the lower Cockfield?</p>

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<p style="text-align: right;">Page 911</p> <p>1 A Yes.</p> <p>2 Q And how do you draw that conclusion, sir?</p> <p>3 A As I stated earlier, you see faulting from</p> <p>4 the surface at various depths into the subsurface all</p> <p>5 the way down into the upper Cockfield, which is where</p> <p>6 most of the -- then on a regional basis you see some</p> <p>7 faulting in the lower Yegua, which is down at the</p> <p>8 level of the lower Cockfield or even lower.</p> <p>9 Q Well, what causes a fault? In the various</p> <p>10 maps that you looked at, is it fair to say that some</p> <p>11 maps show certain faults and other maps don't show</p> <p>12 them. Is that a fair statement?</p> <p>13 A That's correct.</p> <p>14 Q Why is that?</p> <p>15 A It can be a function of several things. It</p> <p>16 can be a function of the well control that was used.</p> <p>17 It can be a function of the data, the vintage of the</p> <p>18 map. At certain times -- let's stick with the Conroe</p> <p>19 field -- through the years, through the decades, they</p> <p>20 went back and gathered additional logs and additional</p> <p>21 data from certain wells. New technology came along</p> <p>22 and they were able to run what are called cased hole</p> <p>23 logs.</p> <p>24 So, for instance, the applicant has</p> <p>25 based their fault identification on the 1936 map. By</p>	<p style="text-align: right;">Page 913</p> <p>1 Q Give me the variation, sir?</p> <p>2 A We'd have to go back and look at the map.</p> <p>3 They would vary from just a few well locations up to</p> <p>4 hundreds of acres.</p> <p>5 Q And in the area of the TexCom site, the area</p> <p>6 of review, what fault block, if any, did Exxon</p> <p>7 identify?</p> <p>8 A Within the area of review they identified a</p> <p>9 number of these fault blocks, scores of these fault</p> <p>10 blocks.</p> <p>11 Q Scores?</p> <p>12 A Yes.</p> <p>13 Q All right. And in what record that you've</p> <p>14 introduced into evidence reflects the scores of fault</p> <p>15 blocks in the TexCom area of review?</p> <p>16 A It's in the 1975 Journal of Petroleum</p> <p>17 Technology Paper, but also in the various exhibits</p> <p>18 that Exxon provided in '72 and in '79 at Railroad</p> <p>19 Commission hearings.</p> <p>20 Q Okay. I'm going to ask you, again, as</p> <p>21 precisely as you can, tell me the number of fault</p> <p>22 blocks in the area of review identified in those</p> <p>23 materials?</p> <p>24 A I don't have a count on them. Exxon</p> <p>25 identified 144 fault blocks for the Conroe field.</p>
<p style="text-align: right;">Page 912</p> <p>1 the '70s, the oil field had developed gamma ray logs</p> <p>2 and also what are called pulse neutron logs. And as</p> <p>3 they were developing problems in the field, they had</p> <p>4 to get a better handle on the subsurface structure of</p> <p>5 the field.</p> <p>6 So Exxon -- Humble Exxon -- went in and</p> <p>7 logged many of these wells with these gamma ray logs</p> <p>8 and with the pulse neutron logs. And that gave them</p> <p>9 just reams of new information that they didn't have</p> <p>10 for the 1936 map.</p> <p>11 Thirty years -- I mean, 40 years later</p> <p>12 in the mid '70s, they had a lot of pressure data that</p> <p>13 they did not have with the 1936 map that the</p> <p>14 application is based on. This pressure data showed</p> <p>15 them that the field is very compartmentalized. So</p> <p>16 they came up and identified 144 different compartments</p> <p>17 within the field, and they attributed many of these to</p> <p>18 faulting. Some of them could be due do stratigraphic</p> <p>19 pinch outs, but they called these fault blocks within</p> <p>20 the field.</p> <p>21 Q How many fault blocks are there, did you say?</p> <p>22 A In 19 -- in the 1975 paper they identified</p> <p>23 144.</p> <p>24 Q And how large are these fault blocks?</p> <p>25 A They're varying size.</p>	<p style="text-align: right;">Page 914</p> <p>1 Q How large is the Conroe field?</p> <p>2 A It's about -- I think about seven miles long</p> <p>3 and about five miles wide.</p> <p>4 Q So in seven miles long and five miles wide,</p> <p>5 assuming that to be correct, you're saying that there</p> <p>6 are 144 fault blocks, correct?</p> <p>7 A That's what Exxon identified.</p> <p>8 Q Okay. Do you disagree with Exxon? Do you</p> <p>9 agree with Exxon? Did you look at any back-up</p> <p>10 information or just their summary reports?</p> <p>11 A I accept their publication.</p> <p>12 Q All right. What is the significance of these</p> <p>13 fault blocks in this matter?</p> <p>14 A Well, the applicant is charged with examining</p> <p>15 any faults within the area of review.</p> <p>16 Q We're going to come to that, sir. But I'm</p> <p>17 asking you: What is the significance of the number of</p> <p>18 fault blocks? You throw it out as if it has</p> <p>19 significance because it sounds like a lot, 144. What</p> <p>20 is the specific significance of the fault blocks?</p> <p>21 A And I was starting to answer that question --</p> <p>22 Q No, you were --</p> <p>23 JUDGE WALSTON: -- asked him the</p> <p>24 significance of the number of the fault blocks or of</p> <p>25 the fault blocks --</p>

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<p style="text-align: right;">Page 915</p> <p>1 MR. RILEY: Well, I was going to ask the 2 number of fault blocks. He keeps referring to the 3 number of fault blocks. 4 JUDGE WALSTON: Sir, on your answers you 5 keep trailing off and -- 6 MR. RILEY: I'm sorry -- 7 JUDGE WALSTON: -- tell the significance 8 of fault blocks. 9 MR. RILEY: I'm sorry, Judge. 10 Q (By Mr. Riley) Here's what I want to 11 understand, Mr. Collier. I'll withdraw the question 12 and try to rephrase. 13 I want to understand when you throw out 14 the number 144 whether the number of fault blocks has 15 any significance by itself? 16 A Yes. 17 Q Okay. And in what regard does the number of 18 fault blocks identified by Exxon in the papers you've 19 mentioned have for this application? 20 A Because it shows, as you would expect with a 21 salt dome structural field -- it shows how complicated 22 it is and it shows how faulted it is, and that is what 23 the applicant is charged with looking at. They are 24 charged with looking at any and all faults -- and not 25 just faults, but when you read their instructions,</p>	<p style="text-align: right;">Page 917</p> <p>1 the Geomap private company record that you purchased, 2 correct? 3 A Correct. 4 Q So, again, the number of fault blocks and 5 Exxon's description of them, all of that information 6 as it pertains to the area of review is contained in 7 your Exhibit 1P, correct? 8 A You would not have 144 fault blocks. Of 9 course we limited our -- the faults we delineated to 10 the area of review. 11 Q What I'm trying to get to is that -- and I 12 apologize if I seem vague -- but I'm wondering if the 13 fault blocks that Exxon identified are different from 14 the fault lines that you've drawn on Exhibit 1P? 15 A Some of them may be. Many of them would 16 be -- I would think would be correlatable. 17 Q Okay. So there's a set of information that 18 you've described that you did not plot on 1P. Is that 19 your testimony? 20 A Exxon may have additional data. 21 Q Based on the records you reviewed and as 22 you've described, all I'm trying to understand is 23 within the area of review, are those the faults that 24 you say exist based on the Exxon data and the other 25 sources that you looked at?</p>
<p style="text-align: right;">Page 916</p> <p>1 they're even charged with looking at fractures. And a 2 fracture is a break in the rock in which there has 3 been no vertical displacement. 4 So the significance is to the number and 5 to the -- whether you want to worry about the number 6 or not, or whether you want to just talk about the 7 significance of fault blocks is that this is what you 8 have to look at to characterize the subsurface for 9 this type of application. And this is the baseline 10 data that you've got to have before you can do 11 reservoir modeling. Because if you do reservoir 12 modeling on the wrong size block -- 13 JUDGE WALSTON: -- I think you are 14 getting far from the question now. 15 WITNESS COLLIER: All right. 16 Q (By Mr. Riley) Doctor, are there faults -- 17 again, I'm trying to drill down on the lines you drew 18 on the map, specifically on page -- or Exhibit 1P -- 19 whether those indicate these fault blocks or faults 20 associated with these fault blocks in detail. In 21 other words, are those all the faults that you say 22 exist in the area of review? 23 A Those are all the faults that we found in the 24 public records that we had access to. 25 Q And by "public records" you're also including</p>	<p style="text-align: right;">Page 918</p> <p>1 A Yes. 2 Q Is it a complete list? 3 A Complete list is -- 4 Q Based on the data you've reviewed -- and I'll 5 do the preamble again -- but all the data you reviewed 6 is your description on Exhibit 1P complete? 7 A Yes. 8 JUDGE WALSTON: Why don't we go ahead 9 and take a break now. We've been going an 10 hour-and-a-half. 11 MR. RILEY: Thank you. 12 JUDGE WALSTON: So we'll take a 13 15-minute break and resume at 10:45. 14 (Recess: 10:30 a.m. to 10:48 a.m.) 15 (TexCom Exhibit No. 73 marked) 16 JUDGE WALSTON: Back on the record. 17 Mr. Riley? 18 MR. RILEY: Thank you, Judge. 19 Q (By Mr. Riley) Dr. Collier, could you look at 20 what I've drawn, again rather crudely on the easel -- 21 or the paper on the easel behind you? 22 A Yes. 23 Q Are you able to make out what I'm attempting 24 to depict in that diagram? 25 A Yes.</p>

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<p style="text-align: right;">Page 919</p> <p>1 Q All right. As you can see, what I've done is</p> <p>2 I tried to illustrate some portions of our discussion</p> <p>3 before the break as to how faults would be found at</p> <p>4 different horizons if indeed it extended -- or a fault</p> <p>5 extended through the various horizons. So if you'll</p> <p>6 follow with me, at the surface, which I think I've</p> <p>7 labeled No. 1 in the diagram. Then I made up a</p> <p>8 hypothetical horizon -- our first horizon which I</p> <p>9 labeled No. 2 and then a hypothetical horizon or</p> <p>10 second horizon that I labeled No. 3. Do you see that?</p> <p>11 A Yes.</p> <p>12 Q Now, if I drew a circle, a bird's eye view</p> <p>13 circle, over that geographic area -- again looking in</p> <p>14 two dimensions -- is it correct to say that I would</p> <p>15 see the fault line move in terms of geographic</p> <p>16 relationship across the circle as I went deeper?</p> <p>17 A Yes.</p> <p>18 Q All right. So if I have a fault at the</p> <p>19 surface of -- in a particular location, if it did</p> <p>20 indeed extend down into the subsurface, then as you</p> <p>21 said earlier it's a matter, to some degree, of</p> <p>22 trigonometry in figuring out where one would find it</p> <p>23 in the subsurface, correct?</p> <p>24 A Yes.</p> <p>25 Q And that -- my summary circle at the bottom</p>	<p style="text-align: right;">Page 921</p> <p>1 (TexCom Exhibit No. 73 admitted)</p> <p>2 Q (By Mr. Riley) Doctor, is it fair to say</p> <p>3 then, if we are concerned with faulting in the</p> <p>4 injection zone that the best evidence of whatever</p> <p>5 type -- wireline, boring logs, well control --</p> <p>6 whatever method one would use to describe faulting in</p> <p>7 the injection zone, the -- that's the interval of</p> <p>8 concern. Would you agree?</p> <p>9 A Interval of concern as far as what?</p> <p>10 Q Well, you've mentioned reservoir modeling.</p> <p>11 And while you know nothing about reservoir modeling,</p> <p>12 you said that faults were important for reservoir</p> <p>13 modeling purposes, correct?</p> <p>14 A Correct.</p> <p>15 Q All right. So one could assume that even</p> <p>16 with your basic knowledge of reservoir modeling, that</p> <p>17 the faults in the injection zone are the ones that</p> <p>18 will affect the modeling, correct?</p> <p>19 A Correct.</p> <p>20 Q So is it fair to say, then, for purposes of</p> <p>21 reservoir modeling that those are the faults we should</p> <p>22 be looking at?</p> <p>23 A Yes.</p> <p>24 Q Now, having said that, those -- as we have</p> <p>25 depicted on the board, those faults could move in and</p>
<p style="text-align: right;">Page 920</p> <p>1 there is showing, again, in a bird's eye view, that if</p> <p>2 I was able to map accurately a fault that extended, as</p> <p>3 I've drawn it, I would actually show three lines</p> <p>4 moving across that circle, correct?</p> <p>5 A Correct.</p> <p>6 Q Now, let's talk about your Exhibit 1P. Am I</p> <p>7 correct that you did not attempt to correlate any of</p> <p>8 the subsurface faults to any of the surface faults</p> <p>9 that you describe in your testimony?</p> <p>10 A Correct.</p> <p>11 Q And am I also correct that regardless of</p> <p>12 whether you start at the surface or you start in a</p> <p>13 horizon, if the fault indeed extends downward or</p> <p>14 upward and you map a different horizon, you'd get the</p> <p>15 same phenomena that is depicted in the diagram</p> <p>16 Applicant's Exhibit 73?</p> <p>17 A Correct.</p> <p>18 MR. RILEY: And by the way, Judges, I've</p> <p>19 premarked that diagram as Applicant's Exhibit 73 and</p> <p>20 I'd offer it into the record as a demonstrative</p> <p>21 exhibit.</p> <p>22 JUDGE WALSTON: Any objection?</p> <p>23 There being no objection, Applicant's</p> <p>24 Exhibit 73 is admitted for demonstrative purposes</p> <p>25 only.</p>	<p style="text-align: right;">Page 922</p> <p>1 out of the injection shown? In other words, you might</p> <p>2 find them at a higher stratum, but depending on the</p> <p>3 slope and depending on the trigonometry depicted, you</p> <p>4 may not find it, it may not exist, in the injection</p> <p>5 zone. Is that correct?</p> <p>6 A No.</p> <p>7 Q Within the area of review? Maybe I wasn't</p> <p>8 specific enough.</p> <p>9 JUDGE WALSTON: Maybe you better restate</p> <p>10 the question.</p> <p>11 MR. RILEY: I'm sorry.</p> <p>12 Q (By Mr. Riley) I didn't try to draw this in</p> <p>13 the diagram, but let's assume that I started with a</p> <p>14 fault for purposes of our discussion to the northeast</p> <p>15 and assume that the diagram now has north to the top,</p> <p>16 south to the bottom, west to the left and east to the</p> <p>17 right? Is that fair?</p> <p>18 A (Indicating)</p> <p>19 Q Yes, that's fine. Yes. Okay?</p> <p>20 A All right.</p> <p>21 Q Now, if I started closer to the northwest</p> <p>22 side of the circle, by the time I got down to the</p> <p>23 injection zone, the fault could have moved or would</p> <p>24 have moved outside of the circle or outside of the</p> <p>25 area of review, agreed?</p>

19 (Pages 919 to 922)

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<p style="text-align: right;">Page 923</p> <p>1 A That's possible.</p> <p>2 Q So we are again concerning ourselves in terms</p> <p>3 of reservoir modeling with faults in the injection</p> <p>4 zone that could affect the modeling, correct?</p> <p>5 A Correct.</p> <p>6 Q So that is the horizon of concern. Would you</p> <p>7 agree with me so far?</p> <p>8 A Correct.</p> <p>9 Q So if I have faulting information, say, from</p> <p>10 the surface, it's not particularly relevant for any</p> <p>11 purpose regarding reservoir modeling. Would you</p> <p>12 agree?</p> <p>13 A Well, depends upon where it is on the</p> <p>14 surface.</p> <p>15 Q Okay. Again, using the trigonometry and --</p> <p>16 again, I'm even going to go with you that all these</p> <p>17 faults go from the center of the earth to the surface</p> <p>18 and that they are findable or identifiable in the</p> <p>19 subsurface. But if it moves out of the area of review</p> <p>20 because of the trigonometry, then it's not of concern</p> <p>21 for reservoir modeling?</p> <p>22 A Correct.</p> <p>23 Q The mapping -- of all the data sources you</p> <p>24 looked at, which do you consider the most reliable?</p> <p>25 A It would be the Exxon data.</p>	<p style="text-align: right;">Page 925</p> <p>1 analysis, depends heavily on the Exxon mapping,</p> <p>2 correct?</p> <p>3 A Correct.</p> <p>4 Q And is that primarily because Exxon, having</p> <p>5 been -- Exxon and its predecessors -- having been in</p> <p>6 that field so long had the longest history of</p> <p>7 attempting to map or identify issues in the Conroe</p> <p>8 field?</p> <p>9 A Correct.</p> <p>10 Q Is it true that on all of Exxon maps, the</p> <p>11 entirety of Exxon's analysis, the faults that the</p> <p>12 Applicant put on it -- in its application show up in</p> <p>13 each case?</p> <p>14 A I believe they do, yes.</p> <p>15 Q All right. So at least we can agree, I hope,</p> <p>16 that the faults that the applicant depicted on its --</p> <p>17 in its area of review, were consistently mapped by</p> <p>18 Exxon in the Conroe field in the area of review?</p> <p>19 A Yes.</p> <p>20 Q Do you have any disagreement with where the</p> <p>21 applicant drew those faults on its maps?</p> <p>22 A No.</p> <p>23 Q Would you agree that as -- well, let me say</p> <p>24 it differently. I don't want to get into qualitative</p> <p>25 statements, but would you agree that the off -- the</p>
<p style="text-align: right;">Page 924</p> <p>1 Q Any particular report? Because the Exxon</p> <p>2 data is inconsistent even within itself, correct?</p> <p>3 A I would not use the word "inconsistent."</p> <p>4 Q It changed over time?</p> <p>5 A Their -- different maps may show different</p> <p>6 faults.</p> <p>7 Q Okay. Well, then, I think you'll give me, at</p> <p>8 least, that -- let's say in 1972 where the Exxon map</p> <p>9 showed a fault, if it didn't reappear, say, in the</p> <p>10 later Exxon mapping, what would you speculate occurred</p> <p>11 in that interval or in that time interval?</p> <p>12 A I don't believe the fault has disappeared.</p> <p>13 Q Do you think Exxon just neglected to map it</p> <p>14 again?</p> <p>15 A They may have. It depends upon the purpose</p> <p>16 for which their later map was made.</p> <p>17 Q So you would agree with me that all of</p> <p>18 Exxon's mapping, the entirety of Exxon's mapping,</p> <p>19 depends on what Exxon's motivation was in developing</p> <p>20 the map?</p> <p>21 A Yes.</p> <p>22 Q Now, despite not knowing Exxon's motivation</p> <p>23 or whether there were contrary maps offered in those</p> <p>24 Railroad Commission proceedings, the source of</p> <p>25 information, both for the applicant and for your</p>	<p style="text-align: right;">Page 926</p> <p>1 throw or the off-set for the -- what I'll call Fault</p> <p>2 No. 1 -- although there's probably a better way to</p> <p>3 refer to it -- which is the fault that extends to the</p> <p>4 southeast of the site across the area of review and is</p> <p>5 the longest line on the applicant's map, the big red</p> <p>6 fault. Do you see that one?</p> <p>7 A Yes.</p> <p>8 Q Would you agree with me that the throw on</p> <p>9 that fault is somewhere between 100 to 150 feet?</p> <p>10 A I'll accept that.</p> <p>11 Q Does that correspond with your review of the</p> <p>12 Exxon data?</p> <p>13 A Yes.</p> <p>14 JUDGE EGAN: Could you speak up a little</p> <p>15 bit, please?</p> <p>16 WITNESS COLLIER: Yes.</p> <p>17 JUDGE EGAN: Thank you.</p> <p>18 JUDGE WALSTON: Can I ask you a</p> <p>19 question, Mr. Riley?</p> <p>20 MR. RILEY: Certainly.</p> <p>21 JUDGE WALSTON: Are you talking about</p> <p>22 this line here?</p> <p>23 MR. RILEY: It is the big red line, yes.</p> <p>24 Unfortunately I haven't come up with a better way to</p> <p>25 refer to it. It's the -- you're exactly right, Judge.</p>

20 (Pages 923 to 926)

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<p style="text-align: right;">Page 927</p> <p>1 JUDGE WALSTON: Okay. My question is I 2 thought you said on the applicant's map. I thought 3 this was his map. 4 MR. RILEY: It also appears on the 5 applicant's map. 6 JUDGE WALSTON: Okay. 7 Q (By Mr. Riley) The second fault that the 8 applicant identified -- and it is referred to in your 9 legend as the -- again marked in red further south and 10 a little further east of the fault we were just 11 discussing -- is the second fault identified by the 12 applicant, correct? 13 A Correct. 14 Q And do you know the throw on that fault? 15 A No. 16 Q Does it sound correct that it would be in the 17 nature of 400 feet? 18 A I'll accept that. 19 Q Before you accept it, let me make sure of 20 my -- I think that's correct based on the applicant's 21 representations and the Exxon information. 22 Was it fair to say, Doctor, that all the 23 other faults drawn on Exhibit 1P are substantially 24 less in terms of offset or throw than the numbers we 25 just discussed?</p>	<p style="text-align: right;">Page 929</p> <p>1 MR. RILEY: Judge, you probably can see 2 that a little better on TexCom Exhibit 72. 3 JUDGE EGAN: I've got it right here. 4 MR. RILEY: Okay. The throw is the 5 vertical travel. 6 JUDGE EGAN: I understand. But I just 7 wanted to make sure I knew what your nomenclature 8 meant. 9 MR. RILEY: I understand. Thank you. 10 Q (By Mr. Riley) And we've been using two 11 terms "throw" and "offset" and I apologize to everyone 12 for doing that, but let's stick with offset as best we 13 can, Dr. Collier. Are those synonymous in terms of 14 our discussion? 15 A That would be fine. 16 Q All right. Now, it was marked -- I'd ask 17 that the last piece of paper handed out be marked as 18 TexCom Exhibit 74. 19 Doctor, could you take a moment and just 20 take a look at what's been marked as Applicant Exhibit 21 74? And I think you'll see that it's -- unfortunately 22 I didn't have time to make it more neat or -- more 23 neat, but as an attempt to label with a number each of 24 the segments you've depicted on your Exhibit 1P. 25 A I've looked at it.</p>
<p style="text-align: right;">Page 928</p> <p>1 A I don't have the -- the throw on each one of 2 those faults compiled. 3 Q Well, fortunately, I've taken the time to do 4 that for you, and let me get an exhibit passed out and 5 then let's resume our discussion. 6 (TexCom Exhibit No. 74 marked) 7 JUDGE EGAN: Would it be okay to ask a 8 clarifying question just so I make sure I understand 9 that testimony before it begins? 10 MR. RILEY: Of course. Yes. 11 JUDGE EGAN: I just want to get some 12 nomenclature right. When y'all were talking about 13 "throw," are you talking about the angle of the fault 14 or are you talking about the depth of the fault or -- 15 WITNESS COLLIER: The amount of movement 16 along the fault line. 17 JUDGE EGAN: So how much difference 18 there is between -- 19 WITNESS COLLIER: If you take this right 20 here, this horizon, if it moves down 20 feet, we have 21 20 feet of throw. So it can be 20 feet lower than 22 where it is -- 23 JUDGE EGAN: Okay. So 400 feet of throw 24 is how much they've separated from each other? 25 WITNESS COLLIER: Yes.</p>	<p style="text-align: right;">Page 930</p> <p>1 Q All right. And just because I don't want to 2 create a misimpression, there are some highlighted 3 segments that we had some difficulty correlating to 4 the Exxon data and would -- meaning nothing untoward, 5 we have labeled with a highlighter and our little 6 handwritten legend is "fictional." And I don't mean 7 to be deprecating. It may be that we just couldn't 8 find it in the Exxon data, but at least we had trouble 9 correlating your line to any of the support materials. 10 MR. WALKER: Your Honor, at this time, I 11 would object. Although this item has not been offered 12 into evidence, I would object to that editorial 13 comment as being a comment upon the evidence as 14 opposed to something helpful to the Court. 15 JUDGE WALSTON: If I understood 16 correctly, he might have picked a better word than 17 "fictional," but he was at least just explaining -- 18 MR. RILEY: Yes, sir. In fact, that was 19 the reason I didn't want it to be anything more than 20 what we intended it to be, which was our difficulty in 21 locating the lines that Dr. Collier drew. 22 Q (By Mr. Riley) Dr. Collier, let me ask you a 23 preliminary question. Did you draw the lines on this 24 map? 25 A No.</p>

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<p>1 Q Who did that work?</p> <p>2 A I had my staff compile this.</p> <p>3 Q And who among your staff do you know who</p> <p>4 actually worked on this diagram?</p> <p>5 A Zack Irwin.</p> <p>6 Q Is that it? Mr. Irwin?</p> <p>7 A Lynn Smith. And then I reviewed all of</p> <p>8 the -- after they marked it, I looked at all of them.</p> <p>9 Q Okay. So is it fair to say then, after these</p> <p>10 individuals compiled the exhibit, that you checked the</p> <p>11 work and you stand by it here today?</p> <p>12 A Yes.</p> <p>13 Q Okay. And at least in terms of methodology,</p> <p>14 do you see what I attempted to do in labeling each of</p> <p>15 the segments you drew with numbers?</p> <p>16 A Yes.</p> <p>17 Q And I came up with -- well, I shouldn't take</p> <p>18 credit for others' work. My colleagues and I came up</p> <p>19 with a total number of 31.</p> <p>20 A Yes.</p> <p>21 Q Now, our numbers 30 and 31 refer to the</p> <p>22 faults that were identified by the applicant, and</p> <p>23 Dr. Langhus specifically, that we depicted in the</p> <p>24 application and have discussed several times this</p> <p>25 morning, correct?</p>	<p>1 of offset, if these faults do -- indeed do exist in</p> <p>2 the injection zone, then it would be the Exxon data we</p> <p>3 would rely on for evaluation of these faults, correct?</p> <p>4 A Yes.</p> <p>5 Q Now, let's start, if you don't mind, with --</p> <p>6 well, let me ask a more general question.</p> <p>7 A Okay.</p> <p>8 Q I know that you don't have it -- have the</p> <p>9 data on a fault or a segment-by-segment basis, but can</p> <p>10 you say in general terms what the maximum offset for</p> <p>11 all the other faults depicted on your Exhibit 1P, what</p> <p>12 is the highest offset that is reflected in your</p> <p>13 exhibit?</p> <p>14 A I couldn't tell you offhand.</p> <p>15 Q All right. The other day when Dr. Langhus</p> <p>16 was testifying -- I don't think you were present for</p> <p>17 the hearing in Conroe -- Dr. Langhus talked about the</p> <p>18 consistency that one would expect to see in the</p> <p>19 Jackson shale formation. In other words, what does it</p> <p>20 look like when -- if you were to pull up a wellbore</p> <p>21 and look at that consistency. Do you have an opinion</p> <p>22 on what the Jackson shale consistency would be or some</p> <p>23 common reference you could help us with?</p> <p>24 A It's predominantly shale or clay or mudstone.</p> <p>25 It has little scattered sand lenses -- a few -- very</p>
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<p>1 A Correct.</p> <p>2 Q So 30 and 31 are just your reflection of the</p> <p>3 faults identified by Dr. Langhus and the applicant in</p> <p>4 the application, correct?</p> <p>5 A No.</p> <p>6 Q I'm sorry.</p> <p>7 A The applicant and the application did not</p> <p>8 identify most of these faults.</p> <p>9 Q No, I'm saying 30 and 31, sir.</p> <p>10 A Oh, 30 and 31, yes.</p> <p>11 Q Yes.</p> <p>12 A Yes. Yes.</p> <p>13 Q And then the rest of the items in this record</p> <p>14 are what you and your staff have added and you stand</p> <p>15 by here today?</p> <p>16 A Yes.</p> <p>17 Q Now, of the remaining faults depicted on your</p> <p>18 Exhibit 1P, are you able to go by number and tell us</p> <p>19 the offset for each of those faults?</p> <p>20 A No.</p> <p>21 Q Is that something that one could do based on</p> <p>22 the Exxon data?</p> <p>23 A Yes.</p> <p>24 Q You would have no data that contradicted the</p> <p>25 Exxon data, so whatever the Exxon data showed in terms</p>	<p>1 few -- sand to silty lenses in it. But the vast</p> <p>2 majority of it, 90-something percent is mudstone.</p> <p>3 Q All right. And to the layperson, mudstone</p> <p>4 seems contradictory, but if I held a sample, let's</p> <p>5 say, out of a wellbore in my hand, can you tell me</p> <p>6 what the consistency would be like?</p> <p>7 A It would be a clay or mud.</p> <p>8 Q Would playdough be a reasonable way to</p> <p>9 describe how it would seem to a lay person?</p> <p>10 A I guess you could use that. Or if you've</p> <p>11 been out in the field and gotten muddy boots and the</p> <p>12 mud sticks on your shoes, that's what we're talking</p> <p>13 about.</p> <p>14 Q All right. So it would seem to be something</p> <p>15 that would not -- something -- it seems to be a</p> <p>16 stratum that would not transmit energy very</p> <p>17 effectively.</p> <p>18 A By "energy" you mean fluid?</p> <p>19 Q No, I'm saying -- by "energy" I mean energy.</p> <p>20 If someone were to hit, I guess, a bucket of mud, it</p> <p>21 would seem to me that the bucket of mud would</p> <p>22 dissipate the energy from a hammer hit so that it</p> <p>23 doesn't necessarily even penetrate down into the deep</p> <p>24 -- or to the bottom of the bucket.</p> <p>25 A Well, I know what you're trying to get at,</p>

22 (Pages 931 to 934)

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<p style="text-align: right;">Page 935</p> <p>1 but it will transmit energy. That's the whole theory 2 and practice behind seismic is that you can -- you can 3 transmit energy through it. Otherwise you would not 4 been able to do seismic profiling. 5 Q Well, and seismic profiles are a matter of 6 bouncing energy off of rock stratum and receiving the 7 echo back and being able to make distinctions like 8 what's mudstone, what's limestone, what's hard rock, 9 things of that nature, correct? 10 A But your question was: Would it transmit 11 energy? And to get to the underlying layers below a 12 mudstone you have to transmit energy through the 13 mudstone in order to get that energy below. So while 14 mudstones do attenuate or while they do weaken the 15 signal, energy will be transmitted through a mudstone. 16 Q Okay. And I'm sorry, I didn't mean to -- I 17 wasn't really referring to seismic. I was more 18 thinking about -- well, you've probably seen those 19 fellows who, you know, either with their head or with 20 their hand break bricks? 21 A That's seismic energy. 22 Q All right. And if one of those bricks was 23 mud, would you expect the same result? In other 24 words, doesn't some -- isn't there some factor 25 associated with the brittleness of the material that</p>	<p style="text-align: right;">Page 937</p> <p>1 Q Now, would you define -- or would you 2 describe the Jackson shale formation as a significant 3 confining layer as it exists around the TexCom 4 facility? 5 A It is a potential significant confining 6 layer. 7 Q And a thousand feet of mudstone would seem to 8 be pretty impermeable to fluid transfer. Is that 9 fair? 10 A To the layman it would. 11 Q Well, how about to the geologist? As between 12 sand and shale, which is more permeable? 13 A The sand is more permeable. 14 Q And as between sand and shale, would water 15 tend to permeate the sand much more readily than the 16 shale? 17 A The sand. 18 Q And can we assume that the rules that we all 19 know fairly well in other contexts of the path of 20 least resistance is where you would find the water or 21 fluid traveling in a relative sense? In other words, 22 you would expect, if something was bounded by shale on 23 one side and a shale on the other side and sand in the 24 middle, would you expect the water to transmit in the 25 sand preferentially?</p>
<p style="text-align: right;">Page 936</p> <p>1 is struck? 2 A Yes, it would transmit a lot less energy. 3 Q So that would be fair then to say that the 4 Jackson shale, a thousand foot in the area of the 5 proposed TexCom well, would transmit energy, say, from 6 above much less effectively than, say, a granite 7 layer. Would you agree? 8 A True. 9 Q Would you expect any cracks in the Jackson to 10 seal themselves if there were a crack in the Jackson 11 shale? 12 A They may or may not. You have to look at the 13 evidence -- the local evidence. 14 Q Fair enough. But as a matter of just the 15 consistency of the formation itself -- at least I can 16 imagine in my head -- it being difficult to keep the 17 mud from merging back into itself. 18 A That's why studies have been done to see 19 whether or not mudstones -- faulting in mudstones can 20 be transmissive or not. 21 Q I understand that. But would you agree with 22 me, at least on a consistency basis, that a mudstone 23 is more likely to reform and seal than, say, a granite 24 stone? 25 A Yes.</p>	<p style="text-align: right;">Page 938</p> <p>1 A Yes. 2 Q Let's go back to the exhibit -- Exhibit 74. 3 Which of these markings indicate horizons mapped above 4 the Jackson shale? 5 A Above the Jackson shale is just the one 6 horizon, which is the -- it's the orange layer, top of 7 Pliocene from Exxon Mobil 2002. 8 Q Okay. The orange layer -- 9 A Well, it's orange color -- 10 Q Orange color -- 11 A -- so orange lines. 12 Q So the orange lines are -- I'm sorry, the one 13 I have in front of me it's very difficult to read the 14 legend. The legend hasn't been changed. It's from 15 your Exhibit 1P, correct? 16 A Yes. 17 Q Let me just take a moment -- 18 A -- second from the bottom is the orange 19 color. 20 Q Okay. Let me just take out 1P. It will be 21 easier for me to refer to it. Okay. 22 Again referring to your legend -- now 23 that I can see it -- as you said, the indication is 24 that the orange lines depict a mapping or horizon 25 which is called the top of the Pliocene --</p>

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<p>1 A Pliocene.</p> <p>2 Q -- Pliocene, I'm sorry. And what does that</p> <p>3 mean to us lay folks as to where the -- where the</p> <p>4 horizon was mapped?</p> <p>5 A This is approximately 500 feet below the</p> <p>6 surface.</p> <p>7 Q So it's still a good distance, again looking</p> <p>8 at exhibit -- I'm not sure the exhibit has depths or</p> <p>9 thicknesses -- but it's still substantially above the</p> <p>10 Jackson shale formation, is it not?</p> <p>11 A Correct.</p> <p>12 Q The -- I note that -- I'm sorry, let me ask a</p> <p>13 different question first.</p> <p>14 Are all the other faults that you depict</p> <p>15 on the exhibit, Exhibit 1P, mapped below the Jackson</p> <p>16 shale?</p> <p>17 A All the other colors except that the --</p> <p>18 Q And I'll call your attention to the dark</p> <p>19 green line. I'm not sure I have it correct, but is</p> <p>20 that also mapped below the Jackson shale?</p> <p>21 A Yes. There are some of them that are mapped</p> <p>22 in the Jackson shale --</p> <p>23 Q Okay.</p> <p>24 A And that is the -- oh, that would be -- well,</p> <p>25 let me get -- the purple.</p>	<p>1 MR. FORSBERG: -- who may not be</p> <p>2 parties.</p> <p>3 MR. WILLIAMS: We have one who is not</p> <p>4 one of our testifying experts.</p> <p>5 JUDGE WALSTON: You have one what?</p> <p>6 MR. WILLIAMS: We have one party here</p> <p>7 who is not one of our testifying experts.</p> <p>8 MR. RILEY: If they're part of TCEQ --</p> <p>9 MR. WILLIAMS: Okay.</p> <p>10 JUDGE WALSTON: Are they part of the</p> <p>11 Commission?</p> <p>12 MR. WILLIAMS: Yes.</p> <p>13 JUDGE WALSTON: Okay.</p> <p>14 MR. FORSBERG: If we could just be</p> <p>15 advised when that period of discussion of that topic</p> <p>16 is over so that we can invite her back?</p> <p>17 MR. RILEY: Of course.</p> <p>18 MR. FORSBERG: Thank you.</p> <p>19 JUDGE WALSTON: Hang on just a second.</p> <p>20 Why don't we go off the record.</p> <p>21 (Discussion off the record)</p> <p>22 JUDGE WALSTON: Okay. Back on the</p> <p>23 record, and let the record reflect that all persons</p> <p>24 who are not authorized by the protective order to be</p> <p>25 in attendance have been excluded from the room.</p>
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<p>1 Q The purple are mapped in the Jackson shale?</p> <p>2 A Yes.</p> <p>3 Q All right. So at least the orange then we</p> <p>4 could say are well above, correct?</p> <p>5 A Correct.</p> <p>6 Q The top of the -- I don't guess top is the</p> <p>7 right way to say it -- but the depth perhaps to the</p> <p>8 upper Cockfield is 5,134 feet. You said you accepted</p> <p>9 that from the application previously, correct?</p> <p>10 A Yes.</p> <p>11 Q So the orange lines down to the top of the</p> <p>12 upper Cockfield are some 4600 feet?</p> <p>13 A Approximately.</p> <p>14 Q Tell me, if you can -- and actually we're</p> <p>15 about to go into some questions about the confidential</p> <p>16 information, Judge, and we just wanted to alert you to</p> <p>17 that.</p> <p>18 JUDGE WALSTON: Okay. Is there anyone</p> <p>19 here -- maybe we need to go over the protective</p> <p>20 order -- that doesn't fit within the criteria? I</p> <p>21 believe everyone here is either a party or a named</p> <p>22 expert.</p> <p>23 MR. FORSBERG: I may have a couple of</p> <p>24 individuals here who are not --</p> <p>25 JUDGE WALSTON: That are not parties?</p>	<p>1 And, Mr. Riley, you'll let us know when</p> <p>2 you're moving out of that topic and into something</p> <p>3 else?</p> <p>4 MR. RILEY: Yes, sir.</p> <p>5 (The following Pages 943 through 968 are</p> <p>6 CONFIDENTIAL and have been separately bound.)</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>

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<p style="text-align: right;">Page 969</p> <p>1 JUDGE WALSTON: Then we'll go ahead and 2 break for lunch. It's noon now, so we'll resume in 3 one hour at one o'clock. 4 (Recess: 11:58 a.m. to 1:02 p.m.) 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25</p>	<p style="text-align: right;">Page 971</p> <p>1 refer to the numbers that you've used as the location 2 on your Exhibit No. 74? 3 MR. RILEY: Yes, Your Honor. 4 JUDGE EGAN: Thank you. 5 Q (By Mr. Riley) Give me just a second, 6 Dr. Collier, to pull that out, and you a second and 7 everyone else to get oriented. 8 Within your materials that you have with 9 you, are you able to elaborate further on some of the 10 back-up information that you relied upon in drawing 11 the various lines on this map? 12 A Yes. 13 Q Okay. Let's start -- let me first get my key 14 so we can follow along. We have labeled one segment 15 that you've drawn on Exhibit 1P, a line that we 16 have -- or given the number 14A. Can you find the 17 source material for the line you drew as a fault that 18 we've labeled 14A? 19 A That's in Exhibit M, the second page, which 20 is first main Conroe -- first main Conroe sand map. 21 Q And within that exhibit and with respect to 22 that line, can you look at your source material and 23 determine whether indeed it depicts a fault or a water 24 contact? 25 A It's hard to tell looking at the map. I</p>
<p style="text-align: right;">Page 970</p> <p>1 AFTERNOON SESSION 2 MONDAY, DECEMBER 17, 2007 3 (1:02 p.m.) 4 JUDGE EGAN: Let's go back on the 5 record. It's about three minutes after 1:00 on 6 December 17th, 2007. 7 Dr. Collier, you're still under oath. 8 And, Mr. Riley, you're in the process of 9 crossing, so please continue. 10 PRESENTATION ON BEHALF OF 11 THE ALIGNED PROTESTANTS 12 (Continued) 13 HUGHERT A. COLLIER, 14 having been previously duly sworn, testified as 15 follows: 16 CROSS-EXAMINATION (Cont'd) 17 BY MR. RILEY: 18 Q Good afternoon, Dr. Collier. 19 A Good afternoon. 20 Q I'd like to start this afternoon by again 21 referring back to your Exhibit 1P and discussing some 22 of the light blue colored faults as you describe them 23 in your prefiled testimony around the proposed TexCom 24 facility. 25 JUDGE EGAN: Could you, where possible,</p>	<p style="text-align: right;">Page 972</p> <p>1 originally identified it as a fault. It could 2 possibly be a water contact on here. 3 JUDGE EGAN: It could be a what? 4 WITNESS COLLIER: A water contact. 5 Q (By Mr. Riley) What is a water contact, 6 Doctor? 7 A Well, what they're showing is if you look at 8 the color coding -- actually they're not showing it as 9 a water contact. Their light green colors are 10 their -- let me pull it up. The darker green color 11 here is what they labeled a gas cap shrinkage. And 12 there's a lighter green color and that's remaining 13 original oil zone. And then you see -- if you come 14 south of it towards the southeast since it's kind of 15 oriented towards that way, that's remaining original 16 gas cap. 17 So what there it could be possibly 18 showing is a contact between the original -- well, 19 they're showing it all as being gas cap and they're 20 looking at the amount of shrinkage. And they -- 21 they're looking at the contact between the gas cap and 22 the oil. So it could be a gas/oil contact there. 23 Q Okay. But you've depicted it on your Exhibit 24 1P as a fault, did you not? 25 A Yes.</p>

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<p style="text-align: right;">Page 973</p> <p>1 Q And that's incorrect, is it not?</p> <p>2 A Yes, it could be.</p> <p>3 Q No -- is it or is it not?</p> <p>4 A Well, the map is so small and their</p> <p>5 contact -- it probably -- I'll say it's incorrect.</p> <p>6 Q All right. By the way, Doctor, back-up</p> <p>7 information for these maps that you've included is</p> <p>8 available at the Texas Railroad Commission. Is that</p> <p>9 correct?</p> <p>10 A Correct.</p> <p>11 Q Have you looked at any data, raw data, that</p> <p>12 went into compiling of the maps that Exxon -- that you</p> <p>13 relied upon from Exxon?</p> <p>14 A I did review the information.</p> <p>15 Q You did review the information. When did you</p> <p>16 do that?</p> <p>17 A When we collected all of the records.</p> <p>18 Q Okay. Now, Doctor, did you personally go to</p> <p>19 the Railroad Commission and look at the back-up</p> <p>20 information that supports the various maps that you've</p> <p>21 introduced with your testimony?</p> <p>22 A I personally went to the Railroad Commission</p> <p>23 and pulled the information with the files.</p> <p>24 Q So when I asked you this question in your</p> <p>25 deposition -- what date was that, then?</p>	<p style="text-align: right;">Page 975</p> <p>1 Q And in what exhibit are you referring to it</p> <p>2 being less than 50 feet?</p> <p>3 A The same one we've been talking about.</p> <p>4 Q Is that Humble Exhibit 8?</p> <p>5 A Yes.</p> <p>6 Q Okay. Could you look at Humble Exhibit 9?</p> <p>7 A All right.</p> <p>8 Q And in Humble Exhibit 9 would you agree that</p> <p>9 it's somewhere between 10 and 40 feet -- I'm sorry, 15</p> <p>10 and 40 feet. I apologize.</p> <p>11 A I'll accept that. Again I can't read the</p> <p>12 numbers on the map.</p> <p>13 Q Where is Humble -- where is the horizon that</p> <p>14 is depicted in Humble Exhibit 8 versus the horizon</p> <p>15 that's depicted in Humble Exhibit 9?</p> <p>16 A The Humble Exhibit 8 sand overlies the Humble</p> <p>17 Exhibit 9, which is the second main Conroe sand QA</p> <p>18 member.</p> <p>19 Q So we are moving deeper in the upper</p> <p>20 Cockfield. Is that correct?</p> <p>21 A Correct.</p> <p>22 Q We're not into the middle Cockfield. We're</p> <p>23 moving within the sands in the upper Cockfield,</p> <p>24 correct?</p> <p>25 A Correct.</p>
<p style="text-align: right;">Page 974</p> <p>1 A It was a couple of months ago we went -- a</p> <p>2 month or two. I don't remember the exact date.</p> <p>3 Q Certainly prior to when I took your</p> <p>4 deposition in Conroe in this matter. Is that correct?</p> <p>5 A Oh, yes.</p> <p>6 Q So when I asked you the question of whether</p> <p>7 you looked at any of the data that supported the Exxon</p> <p>8 maps and you indicated you had not, was that correct?</p> <p>9 A I looked at the data in the files. A lot of</p> <p>10 the data on which this map is based upon is not in the</p> <p>11 files.</p> <p>12 Q Well, I'm going to find the deposition</p> <p>13 question and I'll read it to you and see if your</p> <p>14 answer was truthful at that time. Just give me a</p> <p>15 minute. We'll come back to this.</p> <p>16 A All right.</p> <p>17 Q Moving on though, Doctor, with respect to the</p> <p>18 segment that we've labeled 14B -- you find that on</p> <p>19 your Exhibit 1P?</p> <p>20 A Yes.</p> <p>21 Q And what is the offset for exhibit -- excuse</p> <p>22 me, for Segment 14 -- I'll say 14B -- yes, 14B?</p> <p>23 A It's -- again, it's very hard to read the</p> <p>24 contour lines, but it's -- those are 50-foot contours.</p> <p>25 It's less than 50 feet.</p>	<p style="text-align: right;">Page 976</p> <p>1 Q So as we go from Humble Exhibit 8 down to</p> <p>2 Humble Exhibit 9 -- and by down I mean deeper into the</p> <p>3 earth, correct?</p> <p>4 A Correct.</p> <p>5 Q And would that also be true for Humble</p> <p>6 Exhibit 10?</p> <p>7 A Yes.</p> <p>8 Q We're still going deeper in the upper</p> <p>9 Cockfield -- not into the middle, but still in the</p> <p>10 upper Cockfield, correct?</p> <p>11 A Yes.</p> <p>12 Q And the throw -- or, excuse me, the offset in</p> <p>13 Humble Exhibit 10 for that same indication on the</p> <p>14 Humble map is approximately 40 feet. Is that correct?</p> <p>15 A I'll accept that.</p> <p>16 Q I'm sorry, I mischaracterized it. Somewhere</p> <p>17 between 10 and 40 feet?</p> <p>18 A I'll accept that.</p> <p>19 Q And finally on Humble Exhibit 11, again going</p> <p>20 deeper, correct, in the upper Cockfield --</p> <p>21 A Yes.</p> <p>22 Q And it shows to be somewhere on the order of</p> <p>23 40 feet offset. Is that correct?</p> <p>24 A I'll accept that.</p> <p>25 Q And then Humble Exhibit 12, which is, again,</p>

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<p>1 deeper into the upper Cockfield, above the middle 2 Cockfield, shows that there's no fault. Would you 3 also accept that? 4 A You have to be careful how you phrase it. 5 Q All right. Well, it doesn't show a fault on 6 the depiction, does it? 7 A Right. And it shows no data. They had no 8 data there. 9 Q All right. That's your understanding, 10 correct? 11 A That's what the map shows. 12 Q That's what the map shows. That's your 13 understanding, correct? 14 A Correct. 15 Q Again, we are -- based on our earlier 16 discussion from this morning, we are still talking -- 17 if we look at TexCom Exhibit 72 -- about the horizons 18 in the upper Cockfield just below the Jackson shale, 19 correct? 20 A Correct. 21 Q We are not talking about any mapped horizons 22 in either the middle Cockfield or the lower Cockfield, 23 correct? 24 A Correct. 25 Q Doctor, do you have an opinion as to why</p>	<p>1 hydrocarbons beneath it? 2 A Yes. 3 Q So is it again evidence that the Jackson 4 shale is a confining unit, that it has secured 5 hydrocarbons that have been produced for more than 70 6 years? 7 A No. 8 Q Doctor, the -- I found no fault -- again, 9 based on your evaluation of back-up information -- I 10 found no line that you've drawn, no fault that you say 11 exists, other than the two identified by the applicant 12 that showed an offset -- a vertical offset of more 13 than 60 feet. Do you disagree with that statement? 14 A I'll agree with that. 15 Q Earlier today we discussed a Fall-off test. 16 Do you remember that discussion? 17 A Yes. 18 Q And while I don't think you had very detailed 19 familiarity with Fall-off tests, are you familiar with 20 the term of "radius of investigation"? 21 A Yes. 22 Q What does that mean? 23 A That's the distance out for which the test is 24 characterizing the zone that's being tested. 25 Q All right. Are you familiar with whether</p>
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<p>1 Exxon was particularly interested in mapping the upper 2 Cockfield? 3 A The upper Cockfield is the zone they're 4 producing out of. 5 JUDGE EGAN: I'm sorry, you're going to 6 need to speak into the mic. 7 WITNESS COLLIER: It's the zone they 8 were producing out of. 9 Q (By Mr. Riley) In fact, in the history of 10 the Conroe field, the upper Cockfield is the 11 productive zone. Is that correct? 12 A Correct. 13 Q And there is not production -- or has not 14 historically been production from the middle or lower 15 Cockfield. Is that also correct? 16 A Correct. 17 Q Would it indicate to you, Doctor, as an 18 expert geologist, that the Jackson shale is an intact 19 barrier layer or confining unit by the fact that for 20 some 70 years there's been oil and gas production from 21 the upper Cockfield? 22 A That statement is not entirely true. 23 Q All right. If there were fractures or faults 24 in the Jackson shale that were transmissive 25 vertically, would that not have led to release of the</p>	<p>1 zone -- excuse me, whether a Fall-off test can depict 2 boundary conditions? 3 A Yes. 4 Q And in fact, boundary conditions, Doctor, why 5 don't you explain what boundary conditions are? 6 A A boundary condition could be a ceiling 7 fault. It could be a pinch-out of the unit that's 8 being tested. For instance, if it's a sand -- let's 9 say you go out a thousand feet and the sand is no 10 longer present there, it becomes an impermeable 11 barrier. Various types of things you can detect if 12 you have a boundary condition -- it could be a fault. 13 It could be what geologists call a pinch-out. 14 Q It also could be an opening into a more 15 transmissive sand, could it not? It simply measures a 16 differentiation and pressure at a boundary. Is that 17 correct? 18 A Correct. 19 Q So it is neither -- it doesn't have to be a 20 ceiling feature, it could actually be a more 21 transmissive sand, correct? 22 A Correct. 23 Q And are you aware of the radius of 24 investigation for the Fall-off test? 25 A No.</p>

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<p style="text-align: right;">Page 981</p> <p>1 Q If I represented to you that it was 1500 feet 2 or more and showed no boundary conditions, can you 3 reach any conclusion? 4 A If it -- if it looked at 1500 feet and showed 5 no boundary conditions based upon that test, for the 6 interval that they were testing, you could surmise 7 there's no boundary condition. 8 Q So you would think though -- well, is the 9 test valid for consideration in this case? 10 A It would be evidence that you would want to 11 look at, yes. 12 Q And it would still, whether it's a -- let me 13 withdraw that question -- 14 You relied on earlier in your testimony 15 saying what you thought the applicant should have 16 modeled in terms of permeability, correct? 17 A Yes. 18 Q And for that reason you must think that the 19 Fall-off test was reliable, correct? 20 A Yes. 21 Q And even though it perforated different sands 22 than the applicant proposes to perforate within the 23 same injection zone, would you also agree the test is 24 valid in determining whether there are any boundary 25 conditions within the radius of investigation?</p>	<p style="text-align: right;">Page 983</p> <p>1 words, most wells don't have API numbers. Is that 2 correct? 3 A Yes. I don't know if -- many of the old 4 wells pre-fifties or forties, somewhere in there, they 5 wouldn't have them. 6 Q All right. And, Doctor, I think this is, to 7 some extent, a function of mislabeling in the 8 application of a boring log or a log -- excuse me, I 9 guess it's an electric log -- of -- that was labeled 10 in the application C-425, and you've indicated on this 11 exhibit that the log total depth is 12,494 feet? 12 A Correct. 13 Q And that -- was that because you found it in 14 the application labeled -- I'm sorry -- labeled C-425? 15 A Correct. 16 Q Could you take a minute and look at that log, 17 if you have it before you? 18 A I don't have it with me. 19 Q All right. Let me provide you a copy. But 20 it is in the applicant's exhibits in the well logs 21 Volume 3 of 15, Page 58 of 58. So it should be right 22 at the back. 23 Do you have it now in your hand, Doctor? 24 A Yes. 25 MR. RILEY: Does everybody else have it?</p>
<p style="text-align: right;">Page 982</p> <p>1 A For the radius investigation for the interval 2 that was perforated in the test. 3 Q Okay. Well, if the interval that was 4 perforated was 100 feet or 90 feet, and it was 5 perforated in the lower Cockfield sand, would you find 6 it to be helpful in evaluating any boundary conditions 7 in the lower Cockfield sand for a radius of 1500 feet? 8 A Yes. 9 MR. RILEY: May I have just a minute, 10 Your Honors? 11 JUDGE EGAN: Yes. 12 Q (By Mr. Riley) Doctor, I'd like to call your 13 attention to your Exhibit 1Q in the application. If 14 you would take a moment and pull that out, let's 15 discuss one of your notations on that exhibit. 16 A I have it out. 17 Q All right, Doctor, there is a notation on the 18 TC Howell survey that gives an API number. Can you 19 tell us what an API number is? 20 A It's the American Petroleum Institute, and 21 it's a unique number assigned to -- at least to modern 22 days assigned to every well. 23 Q All right. And is it correct over the course 24 of time, Doctor, the APA -- excuse me -- the API 25 numbers are relatively recent developments? In other</p>	<p style="text-align: right;">Page 984</p> <p>1 Q Doctor, if you'd look at the -- first of all, 2 the applicant labeled the document C-425. Is that 3 correct? 4 A Correct. 5 Q And that was your reason for identifying with 6 the map that's depicted in your Exhibit 1Q? 7 A Correct. 8 Q If you look at it a little more closely 9 perhaps, could you -- do you find where it describes 10 the location of that well or the well that that log 11 represents? 12 A Yes. 13 Q And that would be 500 feet from the -- and 14 it's FNWL, and that stands for from northwest line, 15 correct? 16 A That's correct. 17 Q And 800 feet from east line, correct? 18 A From the east line of the lease and survey. 19 Q And would you agree with me that that 20 corresponds on the map to Well No. C-426? If you'll 21 look at a dry hole up in the TC Howell survey in the 22 upper left-hand -- excuse me, right-hand portion of 23 that survey? 24 A Well, it may. It depends on where they put 25 the northwest line.</p>

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<p style="text-align: right;">Page 985</p> <p>1 Q Does the well log --</p> <p>2 THE REPORTER: I'm sorry, I didn't hear</p> <p>3 the end --</p> <p>4 MR. RILEY: I'm sorry, there was</p> <p>5 something --</p> <p>6 WITNESS COLLIER: That was me.</p> <p>7 Q (By Mr. Riley) Does the well log indicate</p> <p>8 that it was a dry hole?</p> <p>9 A The well log does not indicate that it was a</p> <p>10 dry hole.</p> <p>11 Q Okay. And the -- as best you can tell from</p> <p>12 looking at the depiction -- or the description in the</p> <p>13 well log of the well location -- can you -- can you</p> <p>14 identify the well log as relating to C-426?</p> <p>15 A As far as the description? As far as the</p> <p>16 location?</p> <p>17 Q Yes, sir.</p> <p>18 A It's not going to agree exactly, because it</p> <p>19 says it's 500 feet from the northwest line and</p> <p>20 800 feet from the east line.</p> <p>21 Q But it's certainly not Well 425. Can we at</p> <p>22 least agree that far?</p> <p>23 A Yes.</p> <p>24 Q That is the well log that you're relying on</p> <p>25 for the depth that you associated with Well C-425,</p>	<p style="text-align: right;">Page 987</p> <p>1 A Yes.</p> <p>2 Q Is it your position that every fault within</p> <p>3 the area of review that you mapped in your Exhibit 1P,</p> <p>4 does every one of those faults extend upward to the</p> <p>5 surface?</p> <p>6 A No.</p> <p>7 Q What stops them?</p> <p>8 A Some faults will die out structurally and --</p> <p>9 they'll just -- they just die out. At the end they</p> <p>10 terminate.</p> <p>11 Q Okay. Is it your testimony in your prefiled</p> <p>12 that all of the faults that you've depicted in Exhibit</p> <p>13 1P are transmissive laterally across the faults?</p> <p>14 A No.</p> <p>15 Q Can you be more specific which ones are and</p> <p>16 which ones aren't?</p> <p>17 A No.</p> <p>18 Q Are all the faults that you depicted in</p> <p>19 Exhibit 1P transmissive vertically upward?</p> <p>20 A No.</p> <p>21 Q Do you know which ones are?</p> <p>22 A No.</p> <p>23 Q You mentioned in your prefiled -- on Page 11</p> <p>24 of 41 of your prefiled testimony, you mention on Line</p> <p>25 3 about liquids injected are connate. Can you please</p>
<p style="text-align: right;">Page 986</p> <p>1 correct?</p> <p>2 A Yes.</p> <p>3 MR. RILEY: Thank you, Doctor. I have</p> <p>4 no further questions and I pass the witness.</p> <p>5 JUDGE EGAN: Mr. Williams?</p> <p>6 CROSS-EXAMINATION</p> <p>7 BY MR. WILLIAMS:</p> <p>8 Q Good afternoon, Dr. Collier. My name is John</p> <p>9 Williams. I represent the Executive Director.</p> <p>10 JUDGE EGAN: Microphone.</p> <p>11 MR. WILLIAMS: I'm sorry. Thank you.</p> <p>12 A Good afternoon.</p> <p>13 Q Can you hear me now?</p> <p>14 A Yes.</p> <p>15 JUDGE WALSTON: Yes.</p> <p>16 Q Dr. Collier, does every fault visible at the</p> <p>17 surface extend 6,000 feet below the surface?</p> <p>18 A No.</p> <p>19 Q Do some faults that are visible at the</p> <p>20 surface extend that deep?</p> <p>21 A Yes.</p> <p>22 Q Does every fault that exists at 6,000 feet</p> <p>23 below the surface extend upward to the surface?</p> <p>24 A No.</p> <p>25 Q Do some?</p>	<p style="text-align: right;">Page 988</p> <p>1 explain what connate waters are?</p> <p>2 A Connate water is -- a lot of logging people</p> <p>3 use it to refer to the naturally-occurring fluids that</p> <p>4 are in a formation.</p> <p>5 Q Thank you.</p> <p>6 MR. RILEY: What page was that on?</p> <p>7 JUDGE EGAN: Page 11.</p> <p>8 MR. WILLIAMS: Page 11 of his prefiled.</p> <p>9 JUDGE EGAN: Line 3.</p> <p>10 MR. WILLIAMS: Line 3.</p> <p>11 Q (By Mr. Williams) On your Exhibit 1C, the</p> <p>12 photographs of faults -- the one, two, three, fourth</p> <p>13 page -- Mr. Riley was asking you about the Big Barn</p> <p>14 East Fault. Can you tell me what in that photograph</p> <p>15 tells you that there is a fault there?</p> <p>16 A You notice from where the vehicle is parked</p> <p>17 coming back out towards us, you notice there's a</p> <p>18 section of the road that's repaved.</p> <p>19 Q Okay. The lighter part of the photograph?</p> <p>20 A Well, it's the dark part you see --</p> <p>21 Q Okay. The dark part.</p> <p>22 A The dark part. That is repaved. This is a</p> <p>23 fault -- and I misspoke earlier. It's Carl Norman,</p> <p>24 N-o-r-m-a-n, not Newman.</p> <p>25 Q Right.</p>

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<p style="text-align: right;">Page 989</p> <p>1 A This is a fault that Carl Norman has been 2 monitoring for over 20 years. And what you see here 3 is that periodically you get enough of a bump in the 4 road that they have to go in there and smooth it out 5 and repave part of it. And that's what they've done 6 here. 7 Q Okay. Some of these other faults -- other 8 photographs showing cracks in the pavement, how do you 9 distinguish cracks in the pavement from a fault from 10 cracks in the pavement because of some failure of the 11 subbase in the road? 12 A That's a good question. You want to, one, 13 look and see if there's any evidence for anything 14 subbase in the -- along that part of the road. Is 15 there a culvert? Is there something else extending 16 out on either side, maybe a previous road? 17 If you don't find any kind of evidence 18 for something that could have collapsed, you look for 19 subtle or not-so-subtle differences in elevation. 20 It's basically a bump in the road. You go from one 21 side of these cracks to another. And when you feel 22 that bump and you get out and look at it, and you see 23 that there is an offset, that is evidence to support 24 that that is -- there's strong evidence that could be 25 a fault. Certainly not every crack in the road is a</p>	<p style="text-align: right;">Page 991</p> <p>1 a linear -- to curve a linear feature that many times 2 those prove out to be faults. But you don't have 3 enough evidence here, so you just call it a lineament, 4 which means it's really an abnormal or -- you don't 5 normally see those types of straight to slightly 6 curved features on the surface. 7 Q Okay. And on your Map 1O you have identified 8 a feature known as a sinkhole down toward the 9 southeast perimeter of the two-and-a-half mile radius. 10 There's a blue letter "I" marking the spot. Is that 11 the sinkhole you have pictures of in Exhibit 1C? 12 A Yes. 13 Q I have to admit I'm having trouble seeing a 14 sinkhole in these pictures. Could you help me 15 identify it? 16 A Notice sinkhole is in quotation marks. 17 Q Okay. 18 A I didn't know what else to call it. The 19 feature is so large that it is -- it is very hard to 20 get it within any pictures. 21 Q Okay. 22 A So it's -- notice there's a chain-link fence 23 around it. It's a large elliptical-shaped body. Then 24 the trees -- really kind of the edge of it starts with 25 that brush line or tree line inside the fence.</p>
<p style="text-align: right;">Page 990</p> <p>1 fault. And we that -- there were some of these roads 2 that had a lot of cracks going straight down the road 3 for a long distance. And we got on -- the further we 4 looked we saw that was just poor road construction and 5 poor subbase. 6 There's a linearity to it that also 7 sometimes you can -- you can see extending very subtly 8 off on either side. You may see this continue off 9 across the road and a subtle change in elevation. 10 Q Okay. On your Exhibit 1O, the map of these 11 surface faults, to the left of the four proposed 12 TexCom wells you've got a long curving yellow line, 13 and you've got the -- the name is "Lineament." Could 14 you explain what that is and how you discovered that? 15 A Yes. Underlying most of that yellow line, 16 you can see -- this is based upon -- I think this is a 17 LIDAR image and you can see the subtle indication 18 underneath that line for much of the length of a 19 little drainage. And you can see how the drainage 20 kind of lines up in a slightly curved area. 21 This was one that was pointed out to me 22 by Bob Ringholz with Fugro Geophysical. They had a 23 retired geologist who was -- who is a contemporary of 24 Carl Norman, and that's what he specializes in. So he 25 was not willing to identify this as a fault, but it's</p>	<p style="text-align: right;">Page 992</p> <p>1 Q Okay. 2 A And when you read the articles about the 3 early development of the field, they lost a drilling 4 rig on one location. They lost a christmas tree on 5 another. They had a collapsed feature that resulted 6 in a feature 200 feet in diameter and about -- they 7 estimated to be 800 feet deep. So they had a number 8 of blowouts. That's why took the pictures and that's 9 why it's in quotation marks. 10 Q Okay. 11 A It's not a classical geological sinkhole. 12 Q Right. Could you explain what a christmas 13 tree is in the oil business? 14 A A christmas tree is the structure that sits 15 on top, and it's the -- the valves, the piping, that 16 controls the access to the well and by which the gas 17 flows out. It kind of looks like a -- I guess a 18 roughneck's christmas tree. 19 Q It's not like in a building construction 20 where they put the juniper on top of the building when 21 they finish the -- 22 A No, no. 23 Q No? Okay. In a couple of places in your 24 prefiled -- and I'll direct you to Page 23 of your 25 prefiled testimony --</p>

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<p style="text-align: right;">Page 993</p> <p>1 A (Witness complies)</p> <p>2 Q -- on Lines 11 and 12, you say, "This also</p> <p>3 means that the application is administratively</p> <p>4 incomplete."</p> <p>5 A Yes.</p> <p>6 Q Do you see that?</p> <p>7 A Yes.</p> <p>8 Q Have you ever worked for or been an employee</p> <p>9 of the TCEQ or any of its predecessors?</p> <p>10 A No.</p> <p>11 Q I remember you saying that you've worked on</p> <p>12 Class II well applications. Have you been involved</p> <p>13 with any applications before the TCEQ or its</p> <p>14 predecessors?</p> <p>15 A No.</p> <p>16 Q In your experience with Class IIs before the</p> <p>17 Railroad Commission, do you get notices of deficiency</p> <p>18 on those applications?</p> <p>19 A I never received any.</p> <p>20 Q Okay. But you're familiar with the NOD</p> <p>21 process --</p> <p>22 A Yes.</p> <p>23 Q -- in general?</p> <p>24 Do you have a working idea of what</p> <p>25 things, either at the Railroad Commission or TCEQ,</p>	<p style="text-align: right;">Page 995</p> <p>1 A Yes.</p> <p>2 MR. WILLIAMS: I'll accept those answers</p> <p>3 and pass the witness, Your Honor.</p> <p>4 JUDGE EGAN: All right. Any further --</p> <p>5 any further redirect, Mr. Walker?</p> <p>6 MR. WALKER: Yes, ma'am. Just a few</p> <p>7 questions, if I may.</p> <p>8 REDIRECT EXAMINATION</p> <p>9 BY MR. WALKER:</p> <p>10 Q Dr. Collier, you were asked about the Big</p> <p>11 Barn East Fault. Do you recall that line of</p> <p>12 questioning?</p> <p>13 A Yes.</p> <p>14 Q How close does the Big Barn East Fault get to</p> <p>15 the area of review based upon your observation and</p> <p>16 research?</p> <p>17 A It is right on the edge, but within the</p> <p>18 two-and-a-half mile area of review.</p> <p>19 Q All right. Is there a particular reason or</p> <p>20 rationale for not classifying a fault as major or</p> <p>21 minor if in fact one doesn't so classify?</p> <p>22 A Yes. Again, as I mentioned this morning, it</p> <p>23 would depend upon for what purpose you were</p> <p>24 identifying faults. And in the context of the</p> <p>25 application, the applicant is charged with identifying</p>
<p style="text-align: right;">Page 994</p> <p>1 that staff look for in their administrative review of</p> <p>2 an application?</p> <p>3 A Yes.</p> <p>4 Q And could you please give us an idea of what</p> <p>5 those things are?</p> <p>6 A Well, in the context of this they're looking</p> <p>7 for all of the wells that's within the two-and-a-half</p> <p>8 mile area of review. And the term may be incorrect</p> <p>9 there "inadministratively" incomplete. Certainly</p> <p>10 there are a number of -- there are approximately 100</p> <p>11 more water wells within the two-and-a-half mile area</p> <p>12 of review than what the applicant identified.</p> <p>13 And so I will admit that the term</p> <p>14 "administratively incomplete" may be incorrect, but</p> <p>15 the technical part of what they submitted is certainly</p> <p>16 incorrect, for which TCEQ, you know, may or may not</p> <p>17 have had any knowledge of that. All they could go on</p> <p>18 was the map that was provided, and that map was taking</p> <p>19 the Water Development Board groundwater data base with</p> <p>20 wells that have state ID numbers, and that's the only</p> <p>21 base that they utilized to prepare that map.</p> <p>22 Q Okay. So are you willing to admit then that</p> <p>23 this -- instead of being administratively incomplete,</p> <p>24 this application could have been technically</p> <p>25 incomplete with this information?</p>	<p style="text-align: right;">Page 996</p> <p>1 the presence of faults and fractures, and then having</p> <p>2 identified them, to look at every one and decide</p> <p>3 whether or not they're transmissive. So it makes no</p> <p>4 difference if it's a major or minor fault. Major and</p> <p>5 minor faults can both be transmissive. They can be</p> <p>6 conduits for the upward or the downward movement of</p> <p>7 fluid. So in that regard it doesn't make any</p> <p>8 difference if it's major or minor.</p> <p>9 Q Is it possible for fluid to migrate through</p> <p>10 or along a fault that has a four- or five-foot throw?</p> <p>11 A Yes.</p> <p>12 Q I think there has been some discussion</p> <p>13 earlier, Dr. Collier, of a lack of correlation --</p> <p>14 MR. RILEY: Mr. Walker, could I ask you</p> <p>15 to speak into the microphone? I'm having trouble</p> <p>16 hearing you.</p> <p>17 MR. WALKER: I'm sorry.</p> <p>18 Q (By Mr. Walker) I think there was some</p> <p>19 previous testimony about the lack of correlation</p> <p>20 between the map fault lines. Is there perhaps some</p> <p>21 explanation you can give for that fact I guess?</p> <p>22 A Yes, if we look at a couple of consequences,</p> <p>23 I was questioned earlier regarding my exhibit -- let</p> <p>24 me make sure I have the right one -- Exhibit M, which</p> <p>25 is from the 1972 Railroad Commission hearing. And</p>

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<p style="text-align: right;">Page 997</p> <p>1 your question is, is there a reason for lack of 2 correlation from one map to another, from one strata 3 to another. And we walked through Humble Exhibit 8, 4 9, 10. And then on 11, most of the faults right up 5 close to our injection wells, those faults disappear. 6 And the reason they disappear, there's no well 7 control. The wells didn't go deep enough. 8 And so if the wells don't go deep 9 enough, you have no data to do any mapping. That's 10 why you notice that there's no contour lines over 11 virtually all of the TC Howell survey on Humble 12 Exhibit No. 11. There aren't any at all on Humble 13 Exhibit No. 12. And you see the same thing on Humble 14 Exhibit 13 and 14. 15 And what you see is the area that 16 they're mapping shrinks as you go from 8, 9, 10, 11, 17 12. And the area that they're mapping shrinks because 18 they don't have any well control. They don't have any 19 wells that went deep enough. 20 So are there faults on the map? No. 21 Are there faults that exist there? The map doesn't 22 tell you one way or the other because they had no data 23 for that interval. And that's the same rationale for 24 the Geomap maps. They didn't map all the faults. And 25 for many of these others you have quote -- in</p>	<p style="text-align: right;">Page 999</p> <p>1 MR. RILEY: My legal basis is this 2 witness is not a legal expert and cannot interpret the 3 TCEQ rules, and has never worked in this area, which 4 would be another reason for objecting. 5 JUDGE EGAN: Other than -- you want to 6 lay a better predicate? 7 MR. WALKER: Thank you, Your Honor. 8 Q (By Mr. Walker) Dr. Collier, is there a -- is 9 there a qualification for the kinds of faults that are 10 to be set forth in the application? 11 A None. 12 Q Anything, as far as you know, that only 13 major, substantial faults are to be designated? 14 A No qualifications in regard to that. 15 Q In your experience as a hydrogeologist, 16 Dr. Collier, why is it important to locate all of the 17 faults that can be located, within the area of review? 18 MR. RILEY: Objection. Same objection. 19 He's never done an application for any type of well -- 20 disposal well, Class II or Class I -- and this is 21 obviously referring to an area of review being a 22 regulatory requirement, not some generic term; 23 therefore, I don't think he's qualified to answer that 24 question. 25 JUDGE EGAN: Overruled.</p>
<p style="text-align: right;">Page 998</p> <p>1 quotation marks discrepancies from one map to another 2 depending upon the number of logs they had available 3 the wells they used. And that's why these 4 differences. 5 Q Thank you, Dr. Collier. Let me ask you if 6 you recall the testimony concerning TexCom Exhibit 74 7 and a reference to a line on there that was designated 8 14A. I believe you testified that that reference or 9 that designation was incorrect. Is that right? 10 A Yes. 11 Q If you subtract that particular designation, 12 how many faults did you discover in your research 13 within the area of review? 14 A That makes 23. 15 Q Let me ask you this: How many faults did the 16 applicant designate in the application? 17 A Two. 18 Q Dr. Collier, during your review of the TexCom 19 application, did you have an occasion to review Rule 20 331.121 of the Texas Administrative Code? 21 A Yes. 22 Q What is the requirement set forth in that 23 particular rule with respect to delineation of faults? 24 MR. RILEY: Objection. 25 JUDGE EGAN: Your legal basis?</p>	<p style="text-align: right;">Page 1000</p> <p>1 Q (By Mr. Walker) You can answer the question, 2 Dr. Collier. 3 A Any time you do any kind of study of the 4 subsurface and you want to determine if you can have 5 vertical migration from one bed to another, not only 6 do you have to look at those beds and the properties 7 of those horizons or beds -- and in this case we'll 8 take the Jackson, which is a thousand feet of mudstone 9 and shale, on its own, if there was nothing else, that 10 would be a suitable confining unit and a barrier to 11 vertical migration. 12 But if you have faults in the area -- or 13 if you have artificial penetrations, but we're talking 14 about faults here -- if you have faults in the area 15 below it and above it and in it, then that's a big red 16 flag, and you have to look, as is required in the 17 application, to look at all the faults and identify 18 them because they can potentially be transmissive. 19 Q How many faults, Dr. Collier, did you -- or 20 have you located that extend down into the upper 21 Cockfield area? 22 A 19 of these. 23 Q Does that involve having excluded the one 24 that was referenced as 14A on Exhibit 74? 25 A Yes.</p>

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<p>1 Q Do you know, Dr. Collier, if all of those</p> <p>2 faults, those 19, extending down into the upper</p> <p>3 Cockfield, are they transmissive?</p> <p>4 A No, I do not know if all of them are.</p> <p>5 Q Do you know if none of them are transmissive?</p> <p>6 A I do know that that is not correct. Some of</p> <p>7 them are transmissive.</p> <p>8 Q All right. With respect to your research in</p> <p>9 this particular case -- and let me direct your</p> <p>10 attention to the 1975 paper, the Whitson, Davies and</p> <p>11 Burns paper -- did you find any information that</p> <p>12 reflected fluid migration through any mudstone in the</p> <p>13 area of review?</p> <p>14 A Yes, that's one of the -- that paper is</p> <p>15 Exhibit I. Exxon was having trouble in the field</p> <p>16 because they were losing their gap of gas from these</p> <p>17 main Conroe sands, and the gas was migrating upward</p> <p>18 into the upper Cockfield. That's that pipe log that</p> <p>19 we looked at earlier.</p> <p>20 And if you turn to I and turn to the</p> <p>21 second page, which is Page 814, and look at Figure 2,</p> <p>22 that's the type electric log. And so you see this box</p> <p>23 around first main Conroe sand and 2 through 6 main</p> <p>24 Conroe. Those producing intervals were losing the gas</p> <p>25 up into the upper Cockfield.</p>	<p>1 the cement had deteriorated in some of the wells. So</p> <p>2 in the 1975 paper they have a mathematical formula for</p> <p>3 modeling fluid flow behind pipe, behind casings, out</p> <p>4 in the angular space. They had to include that in</p> <p>5 their reservoir modeling.</p> <p>6 The second conduit that they identified,</p> <p>7 going back to this Exxon Exhibit No. 31, the</p> <p>8 next-to-last page, is migration across faults due to</p> <p>9 juxtaposition of sands. And then the third one on the</p> <p>10 far right is migration of fault plain to shallow</p> <p>11 sands.</p> <p>12 Q Dr. Collier, let me ask you, in your</p> <p>13 professional opinion, hydrogeologically how would you</p> <p>14 categorize the subsurface geology, given everything</p> <p>15 that you've talked about today, of this area of</p> <p>16 review -- simple, complex -- how would you categorize</p> <p>17 it?</p> <p>18 A It's complex. The faulting here makes it</p> <p>19 complex. There are a number of faults scattered</p> <p>20 throughout the Conroe field. And there are a number</p> <p>21 of faults scattered throughout the area of review.</p> <p>22 Most of them are in the subsurface, but there is a</p> <p>23 surface expression of the lineament and one fault even</p> <p>24 on the surface. There is -- it's very complex because</p> <p>25 there's faulting at 500 feet; there's faulting within</p>
Page 1002	Page 1004
<p>1 So Exxon started doing a study, and this</p> <p>2 study is referenced in some of the other Railroad</p> <p>3 Commission hearings. And what they found was they</p> <p>4 were losing their gas because of a pressure</p> <p>5 differential and they developed the field. And the</p> <p>6 gas was in part migrating up fault lanes. So they</p> <p>7 even drew a diagram of this that -- they didn't put it</p> <p>8 in the 1975, but they put it in their Railroad</p> <p>9 Commission hearing that we've been referring to here</p> <p>10 earlier today, the 1979 hearing.</p> <p>11 If you turn to the last page -- that's</p> <p>12 J. And if you turn to the last page of J -- the</p> <p>13 next-to-the-last page. The last page is this plastic</p> <p>14 with a map inserted. And turn to the page before</p> <p>15 that, and you can see Exxon's work in '72 and</p> <p>16 everything was put together in the '75 paper.</p> <p>17 And they show you the conduits -- the</p> <p>18 three conduits that they said existed within the</p> <p>19 Cockfield. One was communication through wellbores</p> <p>20 and behind pipe.</p> <p>21 JUDGE EGAN: And what?</p> <p>22 WITNESS COLLIER: Through the wellbores</p> <p>23 and behind pipe, behind the casing.</p> <p>24 JUDGE EGAN: Okay.</p> <p>25 A And in the 1975 paper they talk about that</p>	<p>1 the lower part of the Jackson confining unit that was</p> <p>2 mapped back in the 1950s in a field trip guidebook;</p> <p>3 and then there's faulting in various -- in all these</p> <p>4 zones within the upper Cockfield.</p> <p>5 And then when you skip to the Geomap and</p> <p>6 look at the base of the Yegua or the lower part, the</p> <p>7 base of the Cockfield, they catch -- even in their</p> <p>8 very simplified map in the sense they didn't try to</p> <p>9 look at every well -- even just selecting just a few</p> <p>10 well logs and mapping they caught faulting below at</p> <p>11 the base of the Yegua as well. So it's very complex</p> <p>12 structurally.</p> <p>13 MR. WALKER: Thank you, Dr. Collier.</p> <p>14 I'll pass the witness .</p> <p>15 JUDGE EGAN: Lone Star?</p> <p>16 MR. GERSHON: No questions.</p> <p>17 JUDGE EGAN: Mr. Forsberg?</p> <p>18 MR. FORSBERG: Nothing, Your Honor.</p> <p>19 JUDGE EGAN: Ms. Collins?</p> <p>20 MS. COLLINS: No questions. Thank you.</p> <p>21 JUDGE EGAN: Mr. Riley?</p> <p>22 MR. RILEY: Yes, I have several.</p> <p>23 JUDGE EGAN: Be reminded that this is</p> <p>24 recross.</p> <p>25 MR. RILEY: Yes, ma'am.</p>

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<p style="text-align: right;">Page 1005</p> <p>1 CROSS-EXAMINATION</p> <p>2 BY MR. RILEY:</p> <p>3 Q Doctor, I thought I understood you to say</p> <p>4 that there isn't adequate data in the Exxon materials</p> <p>5 to determine any faults in the lower Cockfield.</p> <p>6 A The faults that are determined in the lower</p> <p>7 Cockfield are not in the Exxon data. I never said</p> <p>8 that.</p> <p>9 Q I'm asking you, when you were going through</p> <p>10 this just a moment ago with Mr. Walker, and you were</p> <p>11 explaining why you think there is faulting that must</p> <p>12 be considered in this application, I'm asking for your</p> <p>13 evidence of any faults in the lower Cockfield?</p> <p>14 A That is the Geomap structure map on Horizon</p> <p>15 B.</p> <p>16 Q So I should look simply at the Geomap</p> <p>17 structure map on Horizon B for all of your evidence of</p> <p>18 faulting in the lower Cockfield?</p> <p>19 A Well, that needs to be -- no, I would not</p> <p>20 just look at that. That is the only map that's</p> <p>21 present mapped on that horizon.</p> <p>22 Q Okay. Let me try one more time. Tell me all</p> <p>23 of your evidence and indicate to me where your faults</p> <p>24 are found on Exxon materials or otherwise that are</p> <p>25 mapped in the horizon that we've been discussing, the</p>	<p style="text-align: right;">Page 1007</p> <p>1 it.</p> <p>2 Q Or none of them could. Is that also true,</p> <p>3 Doctor?</p> <p>4 A No, because you see that with the faults that</p> <p>5 you have -- that the applicant identified.</p> <p>6 Q So you're certain of two, the ones that the</p> <p>7 applicant has in its application, correct?</p> <p>8 A Yes.</p> <p>9 Q So the other faults you have no evidence,</p> <p>10 zero, none at all, that they extend into the lower</p> <p>11 Cockfield, correct?</p> <p>12 A There are not maps constructed on that.</p> <p>13 Q So you have no evidence, Doctor, that those</p> <p>14 faults that you've depicted extend in the lower</p> <p>15 Cockfield, correct?</p> <p>16 A Correct.</p> <p>17 Q You explained to Mr. Walker just a few</p> <p>18 minutes ago that you are able to determine which of</p> <p>19 those faults are transmissive. Is that correct?</p> <p>20 A No, I did not say that.</p> <p>21 Q You said that you knew that some of those</p> <p>22 faults were transmissive, correct?</p> <p>23 A Yes.</p> <p>24 Q How do you know that if you're not able to</p> <p>25 tell us which faults are transmissive?</p>
<p style="text-align: right;">Page 1006</p> <p>1 lower Cockfield.</p> <p>2 A The Exxon did not map the lower Cockfield.</p> <p>3 Q Is your answer then, Doctor, that you have no</p> <p>4 evidence of any faults in the lower Cockfield?</p> <p>5 A I have no evidence of any maps constructed on</p> <p>6 the lower Cockfield.</p> <p>7 Q Okay. What is all your evidence of all the</p> <p>8 faults in the lower Cockfield?</p> <p>9 A The faults that are found in the upper</p> <p>10 Cockfield, there is good geological -- a valid</p> <p>11 geological conclusion is that some -- not many or all</p> <p>12 of these faults -- would extend even into the lower</p> <p>13 Cockfield.</p> <p>14 Q Well, which ones, Doctor? Since you have</p> <p>15 valid, geological conclusions and good science behind</p> <p>16 your opinion, I'd like for you to be specific as to</p> <p>17 which faults extend into the lower Cockfield.</p> <p>18 A Any or all of them are capable of extending</p> <p>19 into --</p> <p>20 Q That's not my question, Doctor. Based on --</p> <p>21 in your opinion, in all the data you've reviewed and</p> <p>22 all the time you've spent on this application, I would</p> <p>23 like you to tell me which of these faults extend into</p> <p>24 the lower Cockfield.</p> <p>25 A As I said, any or all of them can extend into</p>	<p style="text-align: right;">Page 1008</p> <p>1 A Because Exxon in their studies show that</p> <p>2 certain faults within the field are transmissive.</p> <p>3 Q Okay. Which faults did Exxon show are</p> <p>4 transmissive?</p> <p>5 A They do not identify which particular faults.</p> <p>6 Q Well, that's your conclusion, that Exxon did</p> <p>7 not identify where it was losing its gas cap and which</p> <p>8 wells were involved?</p> <p>9 A They identified throughout the whole field.</p> <p>10 They did not -- they did not do a compilation of which</p> <p>11 faults were transmissive and which were not.</p> <p>12 Q My question is different, Doctor. Were they</p> <p>13 discussing certain wells in which they were losing</p> <p>14 their gas cap?</p> <p>15 A They were discussing the whole field.</p> <p>16 Q They were discussing the whole field. They</p> <p>17 did not explain any further or detail in any greater</p> <p>18 detail where they were losing production because of</p> <p>19 the loss of the gas cap?</p> <p>20 A Not that I remember.</p> <p>21 Q You said that Exxon explained that it had</p> <p>22 three reasons -- I'm sorry, you said that Exxon was</p> <p>23 concerned that it was losing its gas cap, correct?</p> <p>24 A Correct.</p> <p>25 Q And can you tell me, Doctor, the difference,</p>

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<p>1 if any, between transmissivity of gas and fluid in 2 substrata? 3 A Gas will be more transmissive than a liquid. 4 Q Okay. So it is possible that gas could 5 transmit through these faults and liquid would not, 6 correct? 7 A Correct. 8 Q So the indication of gas transmission in a 9 fault is not necessarily indication of fluid 10 transmission, correct? 11 A Well, gas is a fluid. 12 Q You understand what I mean, correct? 13 A Correct. 14 Q So gas transmission as opposed to oil or 15 water would not indicate that oil or water could 16 transmit across that same fault, correct? 17 A It is -- you could have cases where that 18 could be the case, but it is an indication that the 19 fault is transmissive. 20 Q Did you find anywhere in the -- well, 21 transmissive, but again transmissive must be qualified 22 in terms of what is transmitting across the fault, 23 correct? 24 A Correct. 25 Q So back to my question: If we're talking</p>	<p>1 within the Cockfield, correct? 2 A Correct. 3 Q So there was no indication even of 4 transmission of gas outside of the Cockfield formation 5 through the Jackson by faults, correct? 6 A Not in the Exxon data. 7 Q Is there some other data where you found 8 evidence of transmission through faults into upper 9 stratum -- 10 A Yes. 11 Q And what data is that? 12 A If you look at the 1936 AAPG article on the 13 field -- this is Exhibit No. G, the fault map the 14 application is based on -- and turn to Page -- if you 15 turn to the second page of 737 at the bottom, the 16 history of the field, "The site of the Conroe field, 17 after gas seeps had been found on the Rhodes farm ... 18 had attracted the attention of a local group of men. 19 The field was --" 20 Q I'm sorry, I'm not hearing. You're reading 21 into the book and I'm trying to hear what you're 22 saying. 23 A "The site of the Conroe field, after gas 24 seeps had been found on the Rhodes farm on the WS 25 Rhodes survey," the field was first flagged because of</p>
Page 1010	Page 1012
<p>1 about water, there is no evidence in the Exxon 2 materials that any of the faults described by Exxon 3 that were causing a loss of its gas cap are 4 transmissive of water, correct? 5 A Correct. 6 Q Nor is there any indication that those faults 7 are transmissive of oil. Is that also correct? 8 A Correct. 9 Q In fact, Doctor, there's no indication that 10 oil production was lost in the Exxon studies, correct? 11 A (No response) 12 Q Other than through loss of the gas cap, which 13 depressurizes the reservoir, there is no indication 14 that oil was leaking through the Jackson shale into 15 upper zones. Is that correct? 16 A Through faults, correct. 17 Q We'll go to artificial penetrations in a 18 minute. But through faults you found no evidence that 19 any of the faults are transmissive or water or oil, 20 correct? 21 A Correct. 22 Q In fact, I think you said, Doctor, if I'm not 23 mistaken, that the transmission of gas that Exxon was 24 concerned with was transmission within the Cockfield 25 entirely -- not through the Jackson, but entirely</p>	<p>1 gas seeps on the surface. 2 Q We've discussed gas. I asked about oil, oil 3 and water. 4 A And then if you go further in the report -- 5 there's a reference later in the study that they 6 believe that the conduit for the migration of this is 7 through the faults. 8 Q That was in 1936. Am I understanding you 9 correctly? 10 A Yes. 11 Q Tell me, is there production of oil or gas 12 above the Jackson shale in the Conroe field? 13 A Yes. 14 Q So is it more likely or less likely that any 15 gas seeps and/or any oil production seeping -- or oil 16 coming to the surface is from stratum -- productive 17 oil and gas stratum above the Jackson shale rather 18 than below the Jackson shale? 19 A I would say it's more likely because its 20 sourced deeper. So that is probably what sourced the 21 shallow gas even above the Jackson. And then the 22 additional problem you have in the field is -- is some 23 of the blowouts they had in the past are believed to 24 have charged up some of the shallow sands and -- 25 because they were conduits for migration all the way</p>

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<p>1 up through the Jackson up into the shallower sands or</p> <p>2 all the way up to the surface such as you have in</p> <p>3 the --</p> <p>4 Q I'm talking about faults, Doctor. Are you</p> <p>5 talking about something different now? I'm talking</p> <p>6 about faults.</p> <p>7 A About faults.</p> <p>8 Q You're referring to artificial penetrations.</p> <p>9 We'll come to that, I promise.</p> <p>10 A All right.</p> <p>11 Q But let's talk about faults.</p> <p>12 A All right. The APG article references</p> <p>13 permeable faults as being conduits for bringing gas</p> <p>14 specifically -- and I don't remember if it references</p> <p>15 oil and water -- up from the Cockfield up to the</p> <p>16 surface or in shallow sands above the Jackson.</p> <p>17 Q How many millions of barrels of oil have been</p> <p>18 produced from the Conroe field?</p> <p>19 A Several hundred million. I think it's --</p> <p>20 maybe over 500.</p> <p>21 Q And would that indicate to you that there are</p> <p>22 some good, solid confining layers in the Jackson --</p> <p>23 excuse me, in the Conroe field?</p> <p>24 A Yes.</p> <p>25 Q Now, Doctor, you wanted to talk about</p>	<p>1 stratum, the potential for a blowout occurs. Is that</p> <p>2 right?</p> <p>3 A Yes.</p> <p>4 Q So prior to drilling into that strata can we</p> <p>5 fairly conclude that it was under high pressure and</p> <p>6 confined?</p> <p>7 A Yes.</p> <p>8 Q So other than the artificial penetration --</p> <p>9 and perhaps bad practices in drilling that well and</p> <p>10 describing that event -- or, I'm sorry, in that</p> <p>11 event -- that's not indicative of anything other than</p> <p>12 a solid confining layer, correct.</p> <p>13 A Well, these are called -- these are leaky</p> <p>14 faults. They are not solid in the fact that they do</p> <p>15 leak --</p> <p>16 Q Are you talking about faults again? Because</p> <p>17 I was now talking about artificial penetration. I</p> <p>18 assumed a blowout was associated with someone drilling</p> <p>19 in an oil field not taking proper precautions and</p> <p>20 pressure -- and hitting a reservoir under extreme</p> <p>21 pressure and that material coming to the surface and</p> <p>22 blowing out the well.</p> <p>23 A Correct.</p> <p>24 Q All right. So what does that have to do with</p> <p>25 faults?</p>
Page 1014	Page 1016
<p>1 artificial penetration, so let's talk about them.</p> <p>2 Your discussion of blowouts and other happenings in</p> <p>3 the oil field, do you have any knowledge of where</p> <p>4 those events occurred?</p> <p>5 A There was one that occurred -- it's</p> <p>6 referenced as occurring on the -- within the area of</p> <p>7 review in the A-672 J. McHorse survey --</p> <p>8 Q Please tell me what you're looking at so I</p> <p>9 can refer to it.</p> <p>10 A Well, if we look at any of your maps -- we</p> <p>11 can look at 1P or 1Q. And this is referenced, I</p> <p>12 believe, in the 1936 AAPG article. The blowout</p> <p>13 section starts on Page 772 of the article.</p> <p>14 Q And which tract or survey were you referring</p> <p>15 to?</p> <p>16 A It's this one right here (indicating).</p> <p>17 Q Tell me the name again. I can't see that</p> <p>18 far.</p> <p>19 A It's the A-672 J. McHorse -- M-c-H-o-r-s-e.</p> <p>20 Q Okay. Now tell me if I'm wrong, Doctor, that</p> <p>21 a blowout, when one is talking about drilling an oil</p> <p>22 well, is the result of pressure, correct?</p> <p>23 A Yes, that's one way to get it.</p> <p>24 Q So when one does not take the proper</p> <p>25 precaution in drilling into a pressurized underground</p>	<p>1 A I've lost your train on your question. I</p> <p>2 guess --</p> <p>3 Q Okay. We were talking about blowouts and</p> <p>4 artificial penetrations. Are you back to where we</p> <p>5 were discussing?</p> <p>6 A Right.</p> <p>7 Q All right. And a blowout is indicative of a</p> <p>8 solid confining layer until penetrated by an</p> <p>9 artificial penetration, correct?</p> <p>10 A Correct.</p> <p>11 Q How deep was the well that you've been</p> <p>12 discussing as a blowout on survey A-672?</p> <p>13 A I believe it was completed in the upper</p> <p>14 Cockfield.</p> <p>15 Q So that would again indicate that the Jackson</p> <p>16 shale -- at least in the area of that survey -- was a</p> <p>17 strong barrier to migration of hydrocarbons, correct?</p> <p>18 A Correct.</p> <p>19 Q Doctor, is there a difference between the</p> <p>20 movement of oil or gas in the subsurface versus water?</p> <p>21 A Yes.</p> <p>22 Q Could you explain that?</p> <p>23 A Well, they have different buoyances; they</p> <p>24 have different densities.</p> <p>25 Q So oil floats to the top. Is that correct?</p>

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<p style="text-align: right;">Page 1017</p> <p>1 A Correct.</p> <p>2 Q And one would find the gas on top of the oil,</p> <p>3 correct?</p> <p>4 A Correct.</p> <p>5 Q So, therefore, they are under pressure and</p> <p>6 they move upwards. Is that correct?</p> <p>7 A Correct.</p> <p>8 Q As for gravity, does gravity operate in the</p> <p>9 subsurface?</p> <p>10 A Yes.</p> <p>11 Q And is it fair to say that fluids of</p> <p>12 different density would separate the same way they</p> <p>13 would in -- above the subsurface or on the surface?</p> <p>14 In other words, greater density fluids would go to the</p> <p>15 bottom and higher density fluids -- or, excuse me,</p> <p>16 lower density fluids would come to the top?</p> <p>17 A Yes.</p> <p>18 Q As compared to the brine that is in the lower</p> <p>19 Cockfield, do you have any knowledge of the density of</p> <p>20 the injectate?</p> <p>21 A The injectate -- no.</p> <p>22 Q That is proposed by --</p> <p>23 A No, I don't.</p> <p>24 Q -- TexCom?</p> <p>25 Would you expect it to be different from</p>	<p style="text-align: right;">Page 1019</p> <p>1 flag and a permit should be not be granted. Is that</p> <p>2 correct?</p> <p>3 A I won't agree with all of that.</p> <p>4 Q Well, tell me which portions you agree with.</p> <p>5 A They're a big red flag and they have to be</p> <p>6 examined closely to see if the artificial</p> <p>7 penetrations -- if you have the plugging records -- if</p> <p>8 they have been plugged properly, if they have been</p> <p>9 cased properly. The red flag doesn't mean that you're</p> <p>10 going to not be able to have an injection well in</p> <p>11 their vicinity, but they have to be characterized and</p> <p>12 analyzed, each one of them.</p> <p>13 Q And you gave testimony in a case in Wise</p> <p>14 County where you said there were too many artificial</p> <p>15 penetrations around a proposed Class II injection well</p> <p>16 and, therefore, the permit should be denied. Is that</p> <p>17 correct?</p> <p>18 A No, I would not accept that characterization.</p> <p>19 Q Well, in any event, you testified on behalf</p> <p>20 of intervenors in that matter and were opposed -- that</p> <p>21 were opposed to the issuance of the Class II permit</p> <p>22 application.</p> <p>23 A My testimony in that case was not that there</p> <p>24 were too many, but there were artificial penetrations</p> <p>25 within the area of review for which there was not</p>
<p style="text-align: right;">Page 1018</p> <p>1 the brine?</p> <p>2 A Yes.</p> <p>3 Q In what way?</p> <p>4 A Well, I presume it's not going to be exactly</p> <p>5 the same density. It won't have the same salinity.</p> <p>6 Q Would you expect it to be more dense or less</p> <p>7 dense?</p> <p>8 A I would predict that it would be less dense.</p> <p>9 Q Okay.</p> <p>10 A But again, I think the exact injectate has</p> <p>11 not been specified.</p> <p>12 Q So you don't know, is that --</p> <p>13 A I really don't know.</p> <p>14 Q All right. Let's go to -- let's see here. I</p> <p>15 think you said in redirect examination that artificial</p> <p>16 penetrations are a big red flag or something on that</p> <p>17 order. Do you recall your answer to Mr. Walker's</p> <p>18 question?</p> <p>19 A Yes.</p> <p>20 Q All right. You have testified in other</p> <p>21 matters -- in fact, the only other disposal well</p> <p>22 matter where you've given testimony on the same</p> <p>23 points -- is that correct? -- that artificial</p> <p>24 penetrations or a large number of artificial</p> <p>25 penetrations around an injection well are a big red</p>	<p style="text-align: right;">Page 1020</p> <p>1 sufficient documentation and evidence of proper</p> <p>2 plugging.</p> <p>3 Q Okay. Which is more important, the area of</p> <p>4 review or the cone of influence?</p> <p>5 A They are both important.</p> <p>6 Q Which one would you think would be more</p> <p>7 important for purposes of determining whether any of</p> <p>8 the artificial penetrations are likely to be</p> <p>9 transmissive of any injectate?</p> <p>10 A The cone of influence, if it is modeled</p> <p>11 properly.</p> <p>12 Q And you don't do any modeling, so I can't ask</p> <p>13 you questions about whether it was modeled properly in</p> <p>14 this case, correct?</p> <p>15 A Well, we talked about this morning as far as</p> <p>16 the parameters --</p> <p>17 Q Right, but -- I'm sorry. We also talked</p> <p>18 about you've never run a model, you've never submitted</p> <p>19 an application to TCEQ, and you have no earthly idea</p> <p>20 on whether it was modeled correctly in this matter</p> <p>21 other than you disagree with some of the input</p> <p>22 parameters?</p> <p>23 A I will accept the first half of your</p> <p>24 statement, but the second half you can look at the</p> <p>25 parameters and you can have an earthly idea when you</p>

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<p style="text-align: right;">Page 1021</p> <p>1 look at the parameters that were used in the input 2 model. And you don't have to have ever ran a model to 3 know whether or not the input parameters are correct. 4 Q All right. And I understand your position on 5 that. Have you reviewed Mr. Grant's testimony in this 6 matter? 7 A Yes. 8 Q Do you agree with Mr. Grant's conclusions 9 regarding how he modeled the reservoir? 10 A Yes. 11 Q Okay. Again, based on you agree with his 12 input parameters as opposed to the applicant's input 13 parameters? 14 A Yes. 15 Q Tell me the difference between the two models 16 that were run by Mr. Grant and the ones that were run 17 by Mr. Casey. 18 A In the application they're using a 10 square 19 mile area for doing the reservoir modeling. Ten 20 square miles, that's about, you know, a little bit 21 bigger than a three-mile square. And that's too big a 22 block to use when you look, potentially at the nature 23 of faults. If you have faults that are 24 nontransmissive faults, that's basically -- that's not 25 a conservative calculation.</p>	<p style="text-align: right;">Page 1023</p> <p>1 faults in the area, determine which ones are 2 nontransmissive and go ahead and constrain your 3 modeling based upon that. 4 Q And that's what Mr. Grant said he did in his 5 review of the modeling. He ran his own modeling 6 calculation considering the fault that we've been 7 discussing -- I think it's Item No. 30 or Fault No. 30 8 in the spreadsheet -- excuse me, in the exhibit we put 9 together, Exhibit 74, correct? 10 A Correct. 11 Q And Mr. Grant said that he modeled that using 12 a different program as a nontransmissive pressure 13 barrier, correct? 14 A I believe that's right. 15 Q Do you agree with how Mr. Grant modeled the 16 reservoir? 17 A I'll accept his modeling. 18 Q Okay. Is that to say, Doctor, that you agree 19 with Mr. Grant's assessment of the faulting in the 20 area and how he modeled the reservoir? 21 A He did not model as many -- he did not, I 22 think, identify as many faults in the area as we did 23 on our map. 24 Q In fact, he identified one other fault, which 25 was a 50-foot offset fault and that he thought would</p>
<p style="text-align: right;">Page 1022</p> <p>1 Q Do you know the difference between the two 2 models, the one that Mr. Grant used and the one that 3 Mr. Casey used? 4 A I believe they used different programs. 5 Q Okay. Do you know the difference between 6 those two programs? 7 A No. 8 Q Your statement about 10 square miles being 9 too big a block to use, I thought you testified 10 earlier that the applicant modeled -- as you 11 understood it -- as if there were no boundaries in the 12 model. 13 A Well, he used a 10 square mile. 14 Q So there was -- the applicant did depict or 15 did model a boundary condition as you describe, a 10 16 square mile boundary, correct? 17 A Yes. 18 Q So your disagreement with the applicant's 19 model is that you think the 10 square miles is too 20 big? 21 A Yes. 22 Q What model -- what square mileage would you 23 model? 24 A You would have to -- in order to model it 25 properly, you would have to go in and identify all the</p>	<p style="text-align: right;">Page 1024</p> <p>1 not make a difference in the model. Is that correct? 2 A Correct. 3 Q So as we discussed earlier, none of your 4 faults -- not a single one -- shows an offset greater 5 than 60 feet, and that's being generous, isn't it, 6 Doctor? 7 A Correct. 8 Q So if Mr. Grant, who you have adopted his 9 reservoir modeling, since you don't actually do that 10 yourself, you accepted his reservoir modeling and he 11 has dismissed a fault -- 12 MR. WALKER: Your Honor, I have to 13 object at this time. I've been quite patient. I 14 believe all of this questioning is outside the scope 15 of recross. 16 MR. RILEY: It's not at all. He 17 testified about the transmissivity of faults and which 18 faults were transmissive and which faults were not 19 transmissive. He gave testimony about conduits and 20 how the subsurface geology was complex and how it 21 should be modeled. 22 JUDGE EGAN: I'm going to let you go -- 23 overrule the objection, but -- 24 MR. RILEY: I'm going to wrap up in 10 25 or 20 minutes.</p>

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<p>1 JUDGE EGAN: Thank you.</p> <p>2 MR. RILEY: Could I have the last</p> <p>3 question read back? I lost my train of thought.</p> <p>4 (The last question was read as</p> <p>5 requested)</p> <p>6 Q (By Mr. Riley) Mr. Grant found one other</p> <p>7 fault that he thought should have been considered in</p> <p>8 the area of review, correct, Doctor?</p> <p>9 A Correct.</p> <p>10 Q And he reviewed many of the same documents</p> <p>11 that you reviewed. Is that also correct?</p> <p>12 A I don't have a list of what documents he</p> <p>13 reviewed.</p> <p>14 Q All right. But in any event, he didn't think</p> <p>15 that the 50-foot offset or throw was a fault that</p> <p>16 needed to be considered in his modeling. Is that</p> <p>17 true?</p> <p>18 A Correct.</p> <p>19 Q Which faults of the ones that you've</p> <p>20 identified would you have incorporated into a model of</p> <p>21 the reservoir?</p> <p>22 A Well, if I had been doing the application, as</p> <p>23 required by the application, having identified the</p> <p>24 faults, then I have to do a determination of whether</p> <p>25 or not the fault is transmissive. And I would --</p>	<p>1 consider the fault nontransmissive.</p> <p>2 Q I've asked you a different question, though,</p> <p>3 didn't I, Doctor?</p> <p>4 A I'd have to read -- I have to hear the</p> <p>5 question again.</p> <p>6 Q The question was regarding the contaminant</p> <p>7 plume, the constituent of concern to many of the</p> <p>8 people participating in this case, which is more</p> <p>9 conservative in modeling a reservoir, to consider a</p> <p>10 fault transmissive or nontransmissive, if you know?</p> <p>11 A It would be to consider it nontransmissive.</p> <p>12 Q Would be more conservative?</p> <p>13 A Yes.</p> <p>14 Q In terms of lateral extent of the plume?</p> <p>15 A Well, yes, because by -- it's the pressure</p> <p>16 buildup you're interested in and the direction in</p> <p>17 which the fluid will move.</p> <p>18 Q Now, let's go to -- pressure buildup relates</p> <p>19 to artificial penetrations, correct?</p> <p>20 A It can relate to them.</p> <p>21 Q Well, what else does it relate to?</p> <p>22 A Well, your question -- the significance of</p> <p>23 artificial penetrations?</p> <p>24 Q Yes.</p> <p>25 A The significance of artificial penetrations</p>
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<p>1 Q Doctor, I'm going to ask you one more time:</p> <p>2 What faults would you have included in the modeling?</p> <p>3 A And --</p> <p>4 Q I'm not asking what you interpret TCEQ</p> <p>5 requirements to be or how you would do TCEQ business</p> <p>6 if you were in fact employed by the TCEQ. I'm asking</p> <p>7 you what faults you would have employed or used in the</p> <p>8 model?</p> <p>9 A I do not know until I determine the</p> <p>10 transmissive or nontransmissive nature of the faults</p> <p>11 that are north of the northern-most fault that is --</p> <p>12 that the applicant has identified.</p> <p>13 Q So you would only consider -- if you consider</p> <p>14 additional faults, you would only consider the ones</p> <p>15 that are north and -- or west of the big red line</p> <p>16 across Exhibit 1P?</p> <p>17 A If the -- if the big red line fault was</p> <p>18 considered a nontransmissive fault, then those would</p> <p>19 be the ones to concentrate on.</p> <p>20 Q Doctor, if you know, which is more</p> <p>21 conservative in terms of determining the extent of the</p> <p>22 plume, the contaminant plume? Is it more conservative</p> <p>23 or less conservative to consider a fault transmissive?</p> <p>24 A It would be -- well, if you're looking at</p> <p>25 your pressure buildup, then it's more conservative to</p>	<p>1 is they are a conduit if the pressure increases in the</p> <p>2 subsurface to move fluid up vertically.</p> <p>3 Q Okay. In fact, you gave an answer to</p> <p>4 Mr. Walker's questions explaining that artificial --</p> <p>5 regarding the study that Exxon did and the reason</p> <p>6 you're concerned about transmission in the Cockfield</p> <p>7 formation. You gave -- at least your first reason was</p> <p>8 Exxon was concerned that well bores -- the cement in</p> <p>9 wellbores had deteriorated?</p> <p>10 A Correct.</p> <p>11 Q So I assume from that that some part of your</p> <p>12 concern regarding transmission of injectate that would</p> <p>13 be part of the TexCom proposal would occur through</p> <p>14 artificial penetrations?</p> <p>15 A It could potentially, yes.</p> <p>16 Q The point I'm asking you, Doctor, is, if you</p> <p>17 know, the relationship between artificial penetrations</p> <p>18 and the pressure gradient calculated as the cone of</p> <p>19 influence?</p> <p>20 A You have to decide whether or not you're</p> <p>21 going to assume that the artificial penetrations and</p> <p>22 at what pressure they would bleed off, or if they're</p> <p>23 open when you first start the injection.</p> <p>24 Q And are you familiar with the assumptions</p> <p>25 made by Mr. Casey in his modeling regarding any</p>

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<p style="text-align: right;">Page 1029</p> <p>1 artificial penetrations in the cone of influence?</p> <p>2 A I believe he regarded them -- that the -- the</p> <p>3 mud weight would be sufficient so that no fluid would</p> <p>4 move up vertically.</p> <p>5 Q And did Mr. Grant agree with those</p> <p>6 calculations?</p> <p>7 A I don't remember that.</p> <p>8 Q Are there any particular artificial</p> <p>9 penetrations that you are concerned with in this case?</p> <p>10 A Well, the applicant identifies over 200 of</p> <p>11 the artificial penetrations as having incomplete or no</p> <p>12 records on. So you have to be concerned with any of</p> <p>13 those if you have -- if you don't have the records, if</p> <p>14 you don't know what happened to the wellbores.</p> <p>15 Q So even if I had an artificial penetration,</p> <p>16 say, in -- let's pick a -- in the A-688 survey, looks</p> <p>17 like BY Sitton -- that would be an artificial</p> <p>18 penetration of concern?</p> <p>19 A The ones of concern would be one when you</p> <p>20 finished your reservoir modeling, and if it was based</p> <p>21 upon the proper parameters, then based upon that you</p> <p>22 would be especially concerned with artificial</p> <p>23 penetrations within that radius of influence.</p> <p>24 Q Okay. The cone of influence, correct?</p> <p>25 A Yes.</p>	<p style="text-align: right;">Page 1031</p> <p>1 a TCEQ public water supply database, correct?</p> <p>2 A Correct.</p> <p>3 Q I think you would agree with me that the TCEQ</p> <p>4 has access to that database, does it not?</p> <p>5 A Correct.</p> <p>6 Q I think you'd agreed with me that the</p> <p>7 applicant used the Texas Water Development Board</p> <p>8 database for its plot of water wells in the area,</p> <p>9 correct?</p> <p>10 A They used the -- the Water Board ground water</p> <p>11 database.</p> <p>12 Q Groundwater database. And those are wells</p> <p>13 that have been assigned state identification numbers,</p> <p>14 correct?</p> <p>15 A Correct.</p> <p>16 Q The additional -- what database did you</p> <p>17 use -- the additional ones I've mentioned are three,</p> <p>18 correct?</p> <p>19 A You mentioned --</p> <p>20 Q I mentioned the TCEQ public water supply</p> <p>21 database. I mentioned the Texas Water Development</p> <p>22 Board groundwater database. And you used three</p> <p>23 additional databases to come up with your number of --</p> <p>24 A We used two additional, the Lone Star</p> <p>25 Groundwater Conservation District database, and then</p>
<p style="text-align: right;">Page 1030</p> <p>1 Q So it's fair -- even though you disagree</p> <p>2 perhaps with the way the applicant did the reservoir</p> <p>3 modeling -- it is fair to look at the artificial</p> <p>4 penetrations within the cone of influence, correct?</p> <p>5 A Yes.</p> <p>6 Q Of what relevance then is your discussion --</p> <p>7 somewhat lengthy discussion -- of the water wells --</p> <p>8 artificial penetration for water wells in the area of</p> <p>9 review?</p> <p>10 A Well, as far as technical completeness and</p> <p>11 accuracy of the report, the applicant was charged with</p> <p>12 doing an inventory of any water wells within the area</p> <p>13 of review.</p> <p>14 Q So it's simply a regulatory concern, not a</p> <p>15 technical concern from the perspective of water wells</p> <p>16 being drilled into the upper, middle or lower</p> <p>17 Cockfield?</p> <p>18 A Correct.</p> <p>19 Q So again it's from a regulatory perspective,</p> <p>20 one that you don't actually have experience with, as</p> <p>21 to whether the TCEQ required the four or five database</p> <p>22 reviews that you performed in order to come up with</p> <p>23 126 water wells in the area of review?</p> <p>24 A Correct.</p> <p>25 Q And the database review that you did included</p>	<p style="text-align: right;">Page 1032</p> <p>1 the fourth one was the Water Development Board</p> <p>2 reported drillers' log database.</p> <p>3 Q Okay. Without disclosing any information</p> <p>4 regarding what you found, did you not also use -- I'm</p> <p>5 sorry, the P-2 database that relates to oil and gas</p> <p>6 exploration?</p> <p>7 A Yes.</p> <p>8 Q So the additional two databases for water</p> <p>9 wells that you used are a database where water well</p> <p>10 drillers feed that information into the Texas Water</p> <p>11 Development Board, correct?</p> <p>12 A Correct.</p> <p>13 Q Do you know of any quality control on that</p> <p>14 database or is it merely an online database available</p> <p>15 to water well drillers?</p> <p>16 A They can submit their wells online. They can</p> <p>17 all still submit them in hard copy. But they are</p> <p>18 required to submit a driller's log on every well, and</p> <p>19 there is a penalty if they -- if they're caught not</p> <p>20 submitting --</p> <p>21 Q Okay. And I think when we discussed this in</p> <p>22 your deposition, you did not know on what frequency,</p> <p>23 if any, that water well driller database migrates into</p> <p>24 the Texas Water Development Board database that</p> <p>25 assigns state well numbers, correct?</p>

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<p style="text-align: right;">Page 1033</p> <p>1 A Correct.</p> <p>2 Q Similar questions regarding the Lone Star</p> <p>3 Groundwater Conservation District's database. Do you</p> <p>4 know how that database is compiled?</p> <p>5 A It's -- I don't know the exact particulars,</p> <p>6 no.</p> <p>7 Q Do you know how long the groundwater</p> <p>8 conservation district has maintained that database?</p> <p>9 A No.</p> <p>10 JUDGE EGAN: Anything further,</p> <p>11 Mr. Riley?</p> <p>12 MR. RILEY: Just one second, Judge. I'm</p> <p>13 just checking my notes. I don't believe so.</p> <p>14 No, thank you, Judge, I have no further</p> <p>15 questions.</p> <p>16 JUDGE EGAN: All right. I just want to</p> <p>17 mention for the record that Texas -- TexCom Exhibit</p> <p>18 No. 74 was never offered.</p> <p>19 MR. RILEY: Is that the -- I would like</p> <p>20 to offer that. I was going to actually use it with</p> <p>21 another witness on rebuttal, but at this time I'll</p> <p>22 offer it.</p> <p>23 JUDGE EGAN: Any objection to TexCom</p> <p>24 Exhibit No. 74?</p> <p>25 MR. WALKER: No.</p>	<p style="text-align: right;">Page 1035</p> <p>1 production from the Vicksburg and Frio formations?</p> <p>2 A I don't know the answer to that. In the area</p> <p>3 or in the Conroe field?</p> <p>4 Q Just anywhere in and around Montgomery</p> <p>5 County --</p> <p>6 A Well, in the area, that would be yes.</p> <p>7 Q Okay. And isn't the Vicksburg-Frio at a much</p> <p>8 shallower depth than the Cockfield?</p> <p>9 A Yes.</p> <p>10 Q Isn't it true that over time shallow gas</p> <p>11 deposits do seep to the surface -- over geologic</p> <p>12 time -- at a slow rate?</p> <p>13 A Yes, it can.</p> <p>14 Q And in your Exhibit 1J, the next-to-last page</p> <p>15 that showed the schematic cross sections indicating</p> <p>16 migration paths --</p> <p>17 A Yes.</p> <p>18 Q -- can a fault be transmissive of gas</p> <p>19 pressure but not transmissive of liquid pressure?</p> <p>20 A Yes.</p> <p>21 Q And how much -- how much pressure difference</p> <p>22 does there have to be for gas to migrate along a</p> <p>23 fault?</p> <p>24 A I don't know.</p> <p>25 MR. WILLIAMS: That's all, Your Honor.</p>
<p style="text-align: right;">Page 1034</p> <p>1 JUDGE EGAN: There being none, it is</p> <p>2 admitted.</p> <p>3 (TexCom Exhibit No. 74 admitted)</p> <p>4 JUDGE EGAN: All right. Did the ED have</p> <p>5 any further questions?</p> <p>6 MR. WILLIAMS: Yes, I have just three or</p> <p>7 four, Your Honor.</p> <p>8 JUDGE EGAN: All right.</p> <p>9 RECROSS EXAMINATION</p> <p>10 BY MR. WILLIAMS:</p> <p>11 Q Dr. Collier, back to your Exhibit 1G, and you</p> <p>12 mentioned under the history of the field gas seeps had</p> <p>13 been found on the Rhodes farm in the WS Rhodes survey?</p> <p>14 JUDGE EGAN: Could you move the speaker</p> <p>15 closer to you?</p> <p>16 MR. WILLIAMS: I'm sorry.</p> <p>17 Q On Page 2 of 1G, you mentioned about the gas</p> <p>18 seeps had been found on the Rhodes farm in the WS</p> <p>19 Rhodes survey?</p> <p>20 A Yes.</p> <p>21 Q Is that WS Rhodes survey anywhere within the</p> <p>22 area of review for this application?</p> <p>23 A I couldn't tell you that.</p> <p>24 Q Is it true, Dr. Collier, that in the area of</p> <p>25 the Conroe oil field there is also oil and gas</p>	<p style="text-align: right;">Page 1036</p> <p>1 Pass the witness.</p> <p>2 JUDGE EGAN: Any further redirect?</p> <p>3 MR. WALKER: Nothing further, Your</p> <p>4 Honor.</p> <p>5 JUDGE EGAN: The witness maybe excused.</p> <p>6 Thank you.</p> <p>7 WITNESS COLLIER: Thank you.</p> <p>8 JUDGE EGAN: Do y'all want to take a</p> <p>9 break at this point or --</p> <p>10 MR. WILLIAMS: A short one to put all</p> <p>11 our stuff back.</p> <p>12 JUDGE EGAN: Okay.</p> <p>13 MR. RILEY: I've got to get set up, but</p> <p>14 then I'm ready --</p> <p>15 JUDGE EGAN: How about 10 minutes?</p> <p>16 We'll reconvene at a quarter to 3:00.</p> <p>17 (Recess: 2:32 p.m. to 2:47 p.m.)</p> <p>18 JUDGE EGAN: All right. We're going</p> <p>19 back on the record. It's about 10 to 3:00 on</p> <p>20 December 17th, 2007.</p> <p>21 The court reporter mentioned to me that</p> <p>22 the -- there was some concerns about changes that were</p> <p>23 being made by the prefiled witnesses that were being</p> <p>24 made on the stand. So what I'd like each party to do</p> <p>25 after the hearing is send a letter to the court</p>

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<p style="text-align: right;">Page 1037</p> <p>1 reporter of what has been changed on the prefiled 2 testimony for each person that sponsored that witness, 3 and to copy everyone on those changes so that it's 4 very clear. Any problems with that? 5 MR. RILEY: None at all. 6 JUDGE EGAN: Good. And you can do that 7 probably -- preferably before the close -- the court 8 reporter issues her final so she can incorporate it 9 into the record. So y'all get with the court reporter 10 and find out when she would like to -- or when they 11 would like to receive that. That will be fine with 12 me. And unless there's a problem, we'll accept 13 y'all's dates as being fine to do that. 14 MR. FORSBERG: Your Honor? 15 JUDGE EGAN: Yes. 16 MR. FORSBERG: I would just say for the 17 record, the -- I submitted redacted and corrected 18 versions to the court reporter, and I believe it 19 covers all of the changes that were made -- there's 20 only one that was made on the stand, but that was 21 included, and all the redactions were made. 22 JUDGE EGAN: All right. The only ones 23 we're interested are the ones that are actually made 24 on the stand, because the order -- objections we've 25 already ruled on and we're pretty clear what that is.</p>	<p style="text-align: right;">Page 1039</p> <p>1 Ms. Stewart? 2 MR. WALKER: We have no questions, Your 3 Honor. 4 JUDGE EGAN: Mr. Forsberg? 5 MR. FORSBERG: No questions, Your Honor. 6 JUDGE EGAN: Ms. Collins? 7 MS. COLLINS: I do have some questions, 8 just a couple. 9 PRESENTATION ON BEHALF OF 10 LONE STAR GROUNDWATER CONSERVATION DISTRICT 11 (Continued) 12 PHILLIP R. GRANT, 13 having been duly sworn, testified as follows: 14 CROSS-EXAMINATION 15 BY MS. COLLINS: 16 Q Mr. Grant, I'm sorry if you can't see me. 17 I'll try to lean in as much as possible. 18 I noticed on Page 5 of your prefiled 19 testimony you stated that you'd prepared numerous 20 feasibility and siting studies for clients relating to 21 the potential construction of Class I injection wells 22 for their facilities. Could you tell me what a 23 feasibility study is? 24 A Typically, prior to preparing a Class I 25 injection well permit application, a client will ask</p>
<p style="text-align: right;">Page 1038</p> <p>1 So it's just the changes that were made by each 2 witness on the stand. 3 MR. RILEY: And the only reason I 4 interrupted is there were several changes we made, but 5 we also applied a page which was marked as an exhibit. 6 Is that satisfactory? Are we okay with that or would 7 you like us to substitute -- 8 JUDGE EGAN: If you've already made it 9 your letter can simply indicate they were made on the 10 record copy. And if anybody has any questions, they 11 can consult the record copy. 12 MR. RILEY: Thank you, Your Honor. 13 JUDGE EGAN: Okay. I believe we're 14 taking Mr. Grant next or is it Dr. Grant? 15 MR. GRANT: No, it's Mr. Grant. 16 JUDGE EGAN: Mr. Grant. Come on up. 17 Since there's been a huge break, let me go ahead and 18 have your sworn in again, although he is being offered 19 for cross, I believe. 20 (Witness sworn) Your 21 JUDGE EGAN: Okay. And which one of you 22 is going to be -- you had already passed and it was 23 Mr. Hill. 24 MR. HILL: That's right. 25 JUDGE EGAN: Okay. Mr. Walker or</p>	<p style="text-align: right;">Page 1040</p> <p>1 that a feasibility study -- both geologically, 2 engineering and reservoir study -- be performed to 3 determine whether the site is an applicable and 4 acceptable site to put a Class -- or to permit a Class 5 I injection well. And parameters such as geology 6 reservoir mechanics, and artificial penetrations will 7 be typically included in that feasibility analysis. 8 Q Okay. So the feasibility studies that you've 9 done are very much linked to geology and location. Is 10 that correct? 11 A Correct. 12 Q Have you done feasibility studies for any 13 other type of disposal facility? 14 A I believe in the distant past in my career 15 I've done them related to landfills. 16 Q Okay. Are those feasibility studies that 17 you've done with regard to landfills very similar in 18 that they involve whether the location and the geology 19 is suitable for the proposed activity? 20 A Yes, they are, but they're different in that 21 they deal primarily with surface features and surface 22 and near surface geology instead of deep geology. 23 Q Right. Okay. Are they at all different 24 other than the surface geology versus subsurface 25 geology?</p>

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<p style="text-align: right;">Page 1041</p> <p>1 A There's no reservoir mechanics with a surface 2 facility. 3 Q Okay. 4 A That's the main difference. 5 Q Have you ever performed a feasibility study 6 that actually compared one disposal method to another? 7 A Yes. 8 Q Could you describe what those studies 9 involved? 10 A It was primarily looking at whether a high 11 total dissolved solids wastestream would be more 12 amenable to deep well injection versus evaporation, 13 incineration, or RO concentration in off-site 14 discharge. 15 Q What factors did you use in making that 16 comparison, if you can recall? 17 A The net amount of resulting waste that would 18 be left in the biosphere or on the surface, the 19 economic cost for the various alternatives and, in a 20 very limited way, the air emissions involved. 21 Q So is it fair to say in the feasibility 22 studies that you've done comparing waste disposal 23 methods, you weren't just looking at -- well, it 24 sounds like you were looking at economic feasibility, 25 perhaps even practicality. Is that correct?</p>	<p style="text-align: right;">Page 1043</p> <p>1 Q In the right circumstances. As a general 2 matter, what factors would you consider in determining 3 whether one wastewater disposal method is better than 4 another? 5 A Which is the most protective of the 6 environment. 7 Q And that involves geology and everything 8 we've been talking about, correct? 9 A Yes, a lot of different aspects. 10 Q Okay. Assuming -- so I'm -- I think I'm 11 understanding you to say that you can't tell me today 12 that overall injection is the safest form of disposal. 13 Is that correct? 14 A For aqueous liquid waste in the Gulf Coast, 15 it is one of the safer methods of wastewater disposal. 16 Q Okay. Tell me why you think that. 17 A It does not take a wastestream. And if it 18 still contains constituents that could pose a danger 19 to human health or the environment, it puts them away, 20 so to speak, into the deep subsurface where they are 21 no longer in contact with the environment -- 22 Q Assuming -- 23 A -- the surface environment. 24 Q I'm sorry, state that last part again? 25 A They are not -- they are no longer in contact</p>
<p style="text-align: right;">Page 1042</p> <p>1 A That is correct. 2 Q Okay. Was it done for a potential Class 1 3 waste -- nonhazardous waste disposal facility? 4 A Yes, it was. 5 Q Okay. And you were doing that for the 6 applicant in that matter? 7 A The potential applicant. 8 Q Potential applicant. So in your mind, does 9 feasibility involve -- does it involve the degree of 10 environmental protection as well as economics and just 11 the practicality of a location, et cetera? 12 A It involves all of those. It's on a very 13 preliminary level, which is somewhat the definition of 14 feasibility study. And the final yes/no decisions are 15 left to the client. Recommendations can be given and 16 potential disadvantages of each disposal technique can 17 be noted, but the final decision obviously is up to 18 the client. 19 Q Okay. So you're giving them a list of 20 options, basically, based on all the factors? 21 A Correct. 22 Q Okay. I think we've talked before about, 23 generally, your opinion that injection is a form of 24 wastewater disposal is a safe method, correct? 25 A In the right circumstances, yes.</p>	<p style="text-align: right;">Page 1044</p> <p>1 with the surface environment. 2 Q Okay. So assuming everything goes well and 3 as predicted, then you would prefer injection over any 4 other form of disposal. Is that correct? 5 A For certain wastes. 6 Q Okay. 7 A Primarily liquid wastewaters with low 8 concentrations of hazardous constituents. 9 JUDGE EGAN: Could you speak up just a 10 little bit? 11 WITNESS GRANT: Yes, ma'am. 12 Q (By Ms. Collins) And do you understand the 13 wastestream in this case to be one of the preferential 14 wastestreams that you just mentioned? 15 A It is a -- at least the wastestream as 16 described in the TexCom application -- appears to have 17 low levels of chemical constituents below the 18 hazardous level, which, if injected into an 19 appropriate reservoir, would be a good method of 20 disposal. 21 Q Okay. So the -- are you saying that you can 22 actually tell from the amount of information in the 23 application that this type of wastestream would be 24 among those that you would consider appropriate for 25 Gulf Coast geology?</p>

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<p style="text-align: right;">Page 1045</p> <p>1 A Based upon the data that is supplied in the 2 TexCom application, no specific concentrations of the 3 various constituents are given. However, based upon 4 the general classifications of wastes and the fact 5 that it is being applied for as a nonhazardous 6 wastewater injection well, it would appear, based upon 7 what they have supplied in their application, to be an 8 appropriate type of wastestream for deep well 9 injection. 10 MS. COLLINS: Okay. Thank you. No 11 further questions. 12 JUDGE EGAN: All right. Would it be 13 Mr. Lee or Mr. Riley? 14 MR. RILEY: Me. 15 JUDGE EGAN: Okay, Mr. Riley. 16 CROSS-EXAMINATION 17 BY MR. RILEY: 18 Q Good afternoon, Mr. Grant. 19 A Good afternoon. 20 Q Mr. Grant, we've talked about this 21 application previously in deposition. Is that 22 correct? 23 A That is correct. 24 Q And I want to pick up to some degree where 25 Ms. Collins left off. Is it fair to say that a number</p>	<p style="text-align: right;">Page 1047</p> <p>1 Q The number of applications that you've worked 2 on for Class I injection wells, if I remember your 3 testimony correctly, is 20. Is that correct -- or 4 approximately 20? 5 A I think that's a pretty good number. It may 6 vary -- for new well permit applications -- 7 Q It's on Page 4 of your testimony. And I 8 don't -- I wasn't trying to make a point of it other 9 than it does seem as though you've had a number of 10 applications that you've been involved with before the 11 TCEQ for the permitting of underground injection of 12 nonhazardous industrial waste through Class I 13 injection wells, and I think your answer is at least 14 20? 15 A That would be correct. 16 Q All right. Have you permitted any Class I 17 injection wells in the Conroe area or Montgomery 18 County? 19 A No, I have not. 20 Q Let's talk a little bit about -- before we 21 get into some other specifics -- the types of models 22 that were utilized in the reservoir modeling as 23 between the applicant and the model you used. We 24 talked about this in your deposition, but as I 25 understand it, you used a particular model that is</p>
<p style="text-align: right;">Page 1046</p> <p>1 of the clients you represent are engaged in the safe 2 process of liquid waste disposal into injection wells? 3 Is that correct? 4 A That is correct. 5 Q And I don't mean to oversimplify your 6 testimony in this matter, but I think I can sum it 7 up -- I think you do in fact sum it up in your 8 testimony -- that you disagree with certain 9 assumptions and parameters utilized by Mr. Casey in 10 his reservoir modeling. Is that correct? 11 A That is correct. 12 Q But otherwise you do not see the injection 13 zone -- and I'm not speaking generally. I'm talking 14 particularly the injection zone or the Jackson shale 15 or the faults that have been described by other 16 witnesses as disqualifying from an injection well 17 perspective. Is that a fair characterization? 18 A Generally that is a fair characterization. 19 Q Let me go a little more into the specifics. 20 But I do want to at least get clear on the record that 21 you do not see the TexCom site and its proximity to 22 the Conroe oil field as a necessary -- as necessarily 23 disqualifying TexCom from having an 24 environmentally-safe operation. Is that correct? 25 A That is correct.</p>	<p style="text-align: right;">Page 1048</p> <p>1 used by the TCEQ or offered to applicants by the TCEQ 2 referred to as PRESS2. Is that correct? 3 A That is correct. 4 Q All right. And the model that was utilized 5 by Mr. Casey and, ultimately, submitted with the 6 application, is -- I've heard it referred to as 7 BOAST98 -- I think that's the way we have it in the 8 prefiled testimony -- or BOAST98. I think it's 9 BOAST98. Is that correct? 10 A That is correct. 11 Q Now, if I understood your deposition 12 testimony, the PRESS2 modeling is based on algebraic 13 equations, correct? 14 A Yes, it's an analytical solution to pressure 15 increase. 16 Q And the equations utilized in the PRESS2 17 modeling are fundamentally algebraic equations. Is 18 that correct? 19 A That is correct. 20 Q And the BOAST98 modeling that was utilized by 21 the applicant, I think you acknowledged in your 22 deposition that it is a more complex model that takes 23 into consideration different parameters than the 24 PRESS2 model, and is based on differential equations, 25 correct?</p>

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<p style="text-align: right;">Page 1049</p> <p>1 A It's a finite difference model and uses 2 similar input parameters; however, allows for certain 3 reservoir heterogeneities which are additional 4 reservoir descriptors beyond which the PRESS2 model 5 allows. 6 Q All right. And I think I asked you, as best 7 I could articulate it, in your deposition whether you 8 thought it was more likely or less likely -- the 9 BOAST98 model was more likely or less likely to 10 predict the real life or real world conditions. Do 11 you remember those questions? 12 A I do remember those questions, yes. 13 Q Am I correct in remembering your answer was 14 yes; that because it takes into account different -- 15 differing parameters, that it is more likely to 16 reproduce real world conditions? 17 A I believe my answer was that it is more 18 likely to produce a descriptor of flow and transport; 19 however, related to pressure increases, the 20 differences between the two, assuming similar inputs 21 were put in, would be very minimal. 22 Q I appreciate that clarification. That's my 23 recollection, too. But as it pertains then to flow 24 and transport or transfer of the waste -- transport of 25 the waste plume, you would expect BOAST98 to be more</p>	<p style="text-align: right;">Page 1051</p> <p>1 the TexCom application used an analytical solution 2 similar to one I would use. 3 Q And you have no disagreement with that 4 calculation in the -- in TexCom's application. Is 5 that correct? 6 A The calculation of the plume front? 7 Q Yes, sir. 8 A Not that I can recall. 9 Q It's certainly not identified in your 10 prefiled testimony to my recollection. 11 A That is correct. 12 Q So we are then back to discussing the 13 pressure -- pressure front, is that -- 14 A We're essentially back to discussing the 15 pressure increase within the injection reservoir and 16 the resulting cone of influence, depending upon which 17 input parameters one uses. 18 Q All right. Now, you have -- using the PRESS2 19 model, you have modeled the reservoir using 81 20 millidarcies as your permeability. Is that the right 21 term? 22 A That is correct. 23 Q And you have input into the model or into 24 your solution using PRESS2 that the fault to the 25 south, approximately 4400 feet from WDW-315, is</p>
<p style="text-align: right;">Page 1050</p> <p>1 accurate predicting? 2 A Yes, the PRESS2 model does not predict flow 3 and transport of the waste. 4 Q Okay. In your experience then in utilizing 5 PRESS2 with the TCEQ, how do you account for flow and 6 transport in the permit applications you've worked on? 7 A For Class I nonhazardous injection well 8 permit applications, flow and transport is not solved 9 through PRESS2 or through BOAST98. It is presented as 10 an analytical solution in a formula separate from 11 PRESS2. 12 Q Okay. As between that formula separate from 13 PRESS2 and that analytical solution you described and 14 the BOAST98 model, which would you think is more 15 predictive of real world conditions? 16 A The BOAST98 model is more predictive of the 17 plume front at the end of operations and subsequent to 18 that. However, that was not used to determine the 19 plume front in BOAST98. The same analytical solution 20 was provided by the TexCom application as I would do. 21 Q Okay. I'm sorry, I misunderstood -- I didn't 22 hear the last part of what you said. 23 A The BOAST98 model was not used -- was used 24 only to predict pressure increase within the injection 25 reservoir. The determination of the plume front for</p>	<p style="text-align: right;">Page 1052</p> <p>1 nontransmissive. Is that correct? 2 A In one of my scenarios I modeled it as 3 nontransmissive. In the other I modeled is as 4 transparent (sic). 5 Q Okay. So you did it both ways, so to speak? 6 A Correct. 7 Q So the difference then in your first modeling 8 scenario was to change the permeability exclusively, 9 correct? 10 A The attempt in both models was to mimic the 11 BOAST98 model with the exception of the permeability 12 and the no-flow boundaries. 13 Q Okay. Let me try it a different way. As I 14 understand it, in the PRESS2 modeling, one of the 15 input parameters is the permeability, correct? 16 A That is correct. 17 Q And that is also true in the BOAST98 18 modeling, correct? 19 A That is correct. 20 Q In the BOAST98 modeling that Mr. Casey 21 performed, the permeability was assumed or predicted 22 to be 500 millidarcies, correct? 23 A That is correct. 24 Q And in the PRESS2 modeling that you 25 performed, the permeability in all your scenarios was</p>

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<p style="text-align: right;">Page 1053</p> <p>1 assumed to be 81 millidarcies, correct?</p> <p>2 A That is correct.</p> <p>3 Q In two of the scenarios you ran for -- in the</p> <p>4 PRESS2 model, you assumed the fault to the south, the</p> <p>5 4400-foot-away fault, to be transmissive, correct?</p> <p>6 A In one of the scenarios, not two of --</p> <p>7 Q I'm sorry, I misunderstood. Okay. How many</p> <p>8 total scenarios --</p> <p>9 A Correct.</p> <p>10 Q I'm sorry. I misspoke. I apologize. So in</p> <p>11 the first scenario you did, you assumed 81</p> <p>12 millidarcies permeability and the fault to be</p> <p>13 transmissive, correct?</p> <p>14 A That is correct.</p> <p>15 Q And your conclusion was that the cone of</p> <p>16 influence would not be the 750 feet that has been</p> <p>17 clarified in this hearing that Mr. Casey calculated,</p> <p>18 it would be some 3,000 feet. Is that correct?</p> <p>19 A I would need to look at my model outputs, but</p> <p>20 I believe it was somewhere in that range of distance.</p> <p>21 Q Would you mind taking a moment and looking</p> <p>22 through it if you have it before you and confirming my</p> <p>23 recollection?</p> <p>24 A The distance would be 3170 feet.</p> <p>25 Q So your calculation that would most directly</p>	<p style="text-align: right;">Page 1055</p> <p>1 where the sands of the lower Cockfield would -- if the</p> <p>2 fault is transmissive as Mr. Casey modeled it -- would</p> <p>3 expand, so to speak, or the middle Cockfield would</p> <p>4 become available. Is that what you understood from</p> <p>5 the testimony in this case?</p> <p>6 A It was not in the TexCom application that</p> <p>7 specific delineation; however, I believe I heard</p> <p>8 Mr. Casey note that fact in his testimony.</p> <p>9 Q Okay. So in Mr. Casey's model, at 4400 feet</p> <p>10 additional sand -- assuming the fault to be</p> <p>11 transmissive between the lower Cockfield and the</p> <p>12 middle Cockfield -- becomes available, and you noted</p> <p>13 that as a difference in -- from your PRESS2 modeling,</p> <p>14 correct?</p> <p>15 A Yes, that is an additional difference.</p> <p>16 Q Okay. Are there other differences?</p> <p>17 A Not that can be compared directly between the</p> <p>18 two models.</p> <p>19 Q Okay. Let's talk about the width of the</p> <p>20 injection interval. Did you use 145 feet?</p> <p>21 A I did.</p> <p>22 Q So you didn't limit the injection interval to</p> <p>23 the 90 or so feet that is currently perforated. Is</p> <p>24 that correct?</p> <p>25 A No, the purpose of my running these two</p>
<p style="text-align: right;">Page 1054</p> <p>1 correlate with Mr. Casey's calculation is a cone of</p> <p>2 influence of 31 -- I'm sorry, 31 --</p> <p>3 A Yes, a radius of 3170 feet.</p> <p>4 Q And that would correlate to Mr. Casey's</p> <p>5 calculation of a radius of 750 feet, correct?</p> <p>6 A I'm not exactly sure what you mean by</p> <p>7 "correlation" because we didn't use the same input</p> <p>8 parameters.</p> <p>9 Q I understand. And I'm -- you use -- the only</p> <p>10 difference in that input scenario -- your input</p> <p>11 scenario and Mr. Casey's input scenario, other than</p> <p>12 the type of model you ran, which you said were</p> <p>13 equivalent -- was the permeability that Mr. Casey used</p> <p>14 was 500 millidarcies and the permeability you used was</p> <p>15 81 millidarcies?</p> <p>16 A That's not the only difference between the</p> <p>17 two --</p> <p>18 Q That's what I'm trying to understand, so</p> <p>19 please explain.</p> <p>20 A The other differences in the BOAST98 model,</p> <p>21 when the fault was reached some 4400 feet to the</p> <p>22 south, the model thickness to the south expanded to</p> <p>23 some 401 feet to the south of that fault as generated</p> <p>24 or as constructed within the BOAST model.</p> <p>25 Q Okay. And that, according to Mr. Casey, is</p>	<p style="text-align: right;">Page 1056</p> <p>1 models was to make as close a comparison with the</p> <p>2 BOAST model as I could using similar input parameters,</p> <p>3 as similar as I could get, and just varying one input</p> <p>4 parameter, that being permeability.</p> <p>5 Q Your intention --</p> <p>6 A And I'm sorry -- and also whether the fault</p> <p>7 was trans -- was a fault -- a pressure barrier or not.</p> <p>8 Q Okay. So at least your attempt was to</p> <p>9 vary -- in your first scenario, which did not consider</p> <p>10 the fault 4400 feet away as nontransmissive -- Are you</p> <p>11 with me so far, the 3,173 feet that you calculated as</p> <p>12 the cone of influence?</p> <p>13 A 3,170 feet, yes.</p> <p>14 Q 170. I'm sorry. That model run, so to</p> <p>15 speak, in the PRESS2 model -- your intention was to</p> <p>16 vary only one input and that was permeability,</p> <p>17 correct?</p> <p>18 A That was my intention, yes. There were</p> <p>19 small -- the things that I could -- that I could match</p> <p>20 up -- structural dip in the BOAST model is not</p> <p>21 inputable -- to use probably the incorrect term -- but</p> <p>22 it cannot be input into the PRESS2 model. But the dip</p> <p>23 is fairly slight, so it should make very little</p> <p>24 difference as far as the pressure increase goes.</p> <p>25 Q Okay. So that -- I mean, I think I</p>

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<p style="text-align: right;">Page 1057</p> <p>1 understand that the PRESS2 model simply doesn't have 2 considered in it input parameters that go into 3 BOAST98. Is that correct? 4 A There are some input parameters in BOAST98 5 that cannot be put into the PRESS2 model because of 6 the heterogeneities in the reservoir, which can be 7 added into the (inaudible) 8 THE REPORTER: I'm sorry, I didn't hear 9 the last -- 10 WITNESS GRANT: The BOAST98 model. 11 Those heterogeneities essentially being in the BOAST98 12 model is -- it was modeled, the slight structural dip 13 and the change across the fault to a thicker -- to a 14 greater thickness to the south. 15 Q (By Mr. Riley) Is it accurate to say the 16 PRESS2 model considers the injection interval 17 homogenous? 18 A Could you be more clear about homogenous 19 numbers? 20 Q Well, you said that the BOAST98 accounts for 21 more heterogeneity. Is that correct? 22 A Correct. 23 Q So I would assume then, as sort of a 24 corollary to that statement, that the PRESS2 model 25 would look at the reservoir as being more homogenous.</p>	<p style="text-align: right;">Page 1059</p> <p>1 by the TCEQ prior to allowing injection to begin to 2 determine whether the Fall-off test derived 3 permeability is conservative related to the 4 calculation of the cone of influence as presented and 5 originally in the application. 6 Q So in this application the fall -- excuse me, 7 the permeability represented by the applicant, the 8 average permeability, is 500 millidarcies, correct? 9 A As represented by the applicant at -- and the 10 applicant's model is represented as 500 millidarcies. 11 Q Is it your understanding that before any 12 waste could be injected the well would have to be 13 perforated as the applicant has described in its 14 application, and a Fall-off test -- a different 15 Fall-off test would have to be conducted to confirm 16 that the 500-millidarcie assumption was conservative? 17 A If the applicant does perforate -- well, let 18 me rephrase that. This is, I guess, a unique case in 19 that the well was drilled 10 years ago. The permit 20 application has already been -- or the permit -- the 21 completion report has already been turned in and the 22 Fall-off test has already been performed, and the 23 results of that Fall-off test have been submitted. 24 What I am not sure about is whether -- although the 25 applicant states that they will perforate an</p>
<p style="text-align: right;">Page 1058</p> <p>1 A Yes, more geologically homogenous in input 2 parameters, yes, if you want to define it that way. 3 Q All right. 4 JUDGE EGAN: Mr. Grant, could you speak 5 up just a little bit or move the mic a little closer? 6 WITNESS GRANT: Is that better? 7 JUDGE EGAN: Yes. Thank you. 8 Q (By Mr. Riley) All right. With all those 9 considerations that you've described and we've 10 discussed, your objective -- at least in your first 11 model run and the PRESS2 model -- was to see what a 12 change in permeability did in terms of defining the 13 cone of influence, correct? 14 A That is correct. 15 Q As I understand it, Mr. Grant, the TCEQ UIC 16 program addresses permeability post permit -- in 17 addition to pre-permit, there's a requirement post 18 permit regarding permeability. Could you describe 19 that to the ALJs? 20 A Typically, when a new well is drilled, a 21 completion report is turned in to the TCEQ. And in 22 that completion report is a Fall-off test which has 23 calculated or determined an average permeability for 24 the perforated interval. And that average 25 permeability for the perforated interval is reviewed</p>	<p style="text-align: right;">Page 1060</p> <p>1 additional 45 feet of the lower Cockfield prior to 2 injection, that there is any vehicle regulatorily 3 required that that be done. That is the concern that 4 I have. 5 Q Now, are you familiar with the general 6 requirement in TCEQ rules that -- or, excuse me, 7 representations in permit applications are 8 enforceable? 9 A Yes, I am. 10 Q And would you consider the applicant's 11 representation that it will perforate 145 feet in the 12 existing well to be enforceable under that general 13 provision? 14 A I don't know. I don't know the answer to 15 that. 16 Q Would you consider the -- could this well -- 17 assuming we weren't all here in this room and things 18 had been different under the original permit -- well, 19 let me state it differently. 20 Could the applicant inject waste if this 21 permit were granted without any further regulatory 22 process? 23 A Without -- 24 Q Without a new completion report, a 25 confirmation of a Fall-off test and an authorization</p>

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<p style="text-align: right;">Page 1061</p> <p>1 by the agency to accept waste, could all -- would none 2 of that have to happen if this permit application is 3 granted? 4 A I believe that's a possibility. I don't 5 think it's a possibility with the three undrilled 6 permitted wells. But because of the unique situation 7 with this well, I'm not sure that any other, quote, 8 unquote, safety checks would necessarily have to be 9 signed off on by the TCEQ before injection was 10 allowed. 11 Q All right. Could your uncertainty be 12 resolved by a condition in the permit that said that 13 the applicant must adhere to its representations -- 14 whether I think that's necessary or not or TCEQ thinks 15 it's necessary or not -- if there were a condition in 16 the permit that said the applicant must perforate at 17 145 feet at a minimum of the injection interval and do 18 a Fall-off test and follow all of the requirements as 19 if this were a brand new well, would that relieve your 20 concern regarding the assumption made in the 21 application about 500 millidarcies? 22 A If the applicant were -- or if the TCEQ were 23 to include in the final draft permit that the 24 applicant perforate the additional 45 feet as noted in 25 the application, and that an additional -- a new</p>	<p style="text-align: right;">Page 1063</p> <p>1 with my colleague. 2 A The tabs are upside down. 3 (Laughter) 4 Q It's a lot of paper. Take your time. 5 A Page what? 6 Q Page 6 of 24. 7 A I have Page 6. 8 Q You see "Special Conditions G," letter G? 9 A Yes, I see that. 10 Q Okay. Does not this condition address your 11 concern regarding the permittee's obligations with 12 respect to WDW 315, which will become WDW 410? 13 A It does not address issues related to 14 specifically performing another Fall-off test. 15 Q If we added to the special condition that 16 this well would follow the path of all other wells 17 that are recompleted in different intervals that the 18 regulatory process that's in TCEQ rules would be 19 required just as it would for any other well, would 20 that address your concern? 21 A Well, the rules for recompleting into another 22 interval are not as complete as the requirements for a 23 new well as far as confirming reservoir conditions. 24 Q Fair enough. But if it were to say that this 25 would be treated as if it were a new well after</p>
<p style="text-align: right;">Page 1062</p> <p>1 Fall-off test be performed over that newly expanded 2 perforated interval, and that the results of that 3 Fall-off test be reviewed to be conservative or if an 4 enlarged cone of influence were determined to be found 5 based upon that permeability, and any additional 6 artificial penetrations within that enlarged cone of 7 influence were to be researched and found to be 8 nonendangering as far as movement into a USDW, then I 9 would feel a lot better about that, assuming the issue 10 of a nontransfer -- or a pressure boundary be 11 addressed in the modeling, I do believe that it would 12 be possible to determine if that pressure boundary is 13 there and running a new Fall-off test. 14 Q Let's explore that, because that's where I 15 want to go next. But I recognize your answer was very 16 precise and I do appreciate it. But I would like to 17 call your attention to Page No. 6 of the draft permit, 18 and Condition G. 19 A Is that in -- where would that be found in -- 20 Q It's TexCom Exhibit 27, Page 6 of 24 in 21 Volume 11. 22 A Exhibit -- 23 Q I'm sorry, it's Exhibit 27, Page 6 of 24. 24 A In Volume 11 there is no exhibit -- 25 Q Well, I was told Volume 11. Let me confer</p>	<p style="text-align: right;">Page 1064</p> <p>1 recompletion as described in the application's -- 2 detailed in that condition, would that address your 3 concern? 4 A If the specific issues, as I previously 5 stated, related to additional perforations, Fall-off 6 tests, recalculation of cone of influence, 7 reevaluation of artificial penetrations within a 8 revised cone of influence, and potential changes to 9 the operating parameters based upon the results of 10 that remodeling and determination of any artificial 11 penetration issues, were specifically addressed or 12 noted in here, then I would feel a lot -- I would feel 13 like that the concerns that I have have been -- are 14 being addressed. 15 Q All right. So that would take care of the 16 Item No. 1 that we were discussing at a minimum, which 17 would be the -- I don't mean to be coy or cute about 18 it -- but who is correct about the permeability or the 19 average permeability in the injection interval, 81 20 millidarcies versus 500, that would be addressed in 21 that process, correct? 22 A I believe the Fall-off test that would be 23 subsequently performed after reperforating would 24 address the issue of what the average permeability of 25 the injection reservoir is. That is correct.</p>

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<p style="text-align: right;">Page 1065</p> <p>1 Q All right. And that would resolve the 2 difference you have with the application based on a 3 prior Fall-off test in a different interval; that 4 would be sorted out by a subsequent Fall-off test on a 5 new perforation if indeed that process was followed, 6 correct? 7 A Yeah, that would -- that would answer the 8 question related to the permeability of the reservoir 9 and -- but not necessarily the issue of a no-flow 10 boundary. 11 Q Okay. Let's talk about the no-flow boundary. 12 There was some discussion -- I think you've been here 13 for the entire hearing. If I'm mistaken, please 14 correct me. 15 A No, that is correct. 16 Q There was some discussion of whether a 17 Fall-off test would show a pressure boundary. And, at 18 least in Mr. Casey's testimony, indeed a Fall-off test 19 does indicate whether there is a pressure boundary 20 around the well. Is that correct? 21 A Out to the radius of investigation of the 22 Fall-off test, yes, it would be an indicator as to 23 whether there was a no-flow boundary, an enhanced 24 permeability or enhanced thickness boundary, and/or 25 potentially a partially penetrating reservoir.</p>	<p style="text-align: right;">Page 1067</p> <p>1 uncertainty regarding the well that's already drilled 2 and what the requirements would be, but what about the 3 other three wells? 4 A It is my belief that the other three 5 undrilled wells would have to meet the standards of 6 completion as set out in the TCEQ rules for 7 demonstrating those specific issues. 8 Q So any uncertainty you have regarding 9 additional Fall-off tests and pre-approval and, I 10 guess, review of permeability and cone of influence, 11 that attaches only to the existing well, correct? 12 A I believe that is correct. 13 Q Mr. Grant, as I understand it -- and please 14 correct me if I'm wrong -- that the modeling 15 associated with a Class I well that we're discussing, 16 whether it be the PRESS2 or the BOAST98, that those 17 models and the TCEQ requirements regarding use of 18 those models impose very conservative assumptions. Do 19 you agree with that? 20 A Yes, I agree with that. 21 Q And in your experience in dealing with Class 22 I wells, have you found after completion of a well, 23 and conducting a Fall-off test that TCEQ has been lax 24 in its enforcement of its own requirements? 25 A Not with the permit applications that I have</p>
<p style="text-align: right;">Page 1066</p> <p>1 Q So again, out to the radius of investigation, 2 which in an earlier Fall-off test was 1500 feet, 3 correct? 4 A I believe that is correct. 5 Q The Fall-off test is useful to determine -- 6 for determining whether there are any pressure 7 boundaries, which could include a greater 8 transmissivity or greater permeability, or a 9 nontransmissive fault or other barrier, correct? 10 A It would be -- Fall-off tests within the 11 radius of investigation can provide data which, upon 12 analysis and review of both the semi log and the log 13 curves -- which are essentially certain analyzable 14 drafts of a Fall-off test -- can pick up no-flow 15 boundaries which would be potentially either a 16 pinch-out or a laterally-sealing fault -- can, if 17 properly performed -- again, I should make that a 18 caveat -- also determine if there's permeability 19 changes at some position out in the reservoir as well 20 as determining if there is a leaky aquifer response 21 within the reservoir. 22 Q Is there any question in your mind, 23 Mr. Grant, that for the three wells that are not 24 drilled, the same procedure would have to be followed 25 under TCEQ rules? I mean, I know you have some</p>	<p style="text-align: right;">Page 1068</p> <p>1 submitted and the completion reports that I have 2 turned in to the TCEQ. But I can only speak for my 3 own applications. 4 Q That's all I'm asking you to do, sir. 5 How about the monitoring and reporting 6 requirements for UIC wells in general, Class I wells, 7 are they rigorous in your opinion? 8 A I believe they are. 9 Q Could you describe what they are, what the 10 frequency is for additional information being 11 submitted to the TCEQ and what the review process is? 12 A Are we talking about after the well is online 13 and injecting? 14 Q Yes, let's talk about that. What is the 15 process, in your experience in dealing with the TCEQ, 16 after a well is online and injecting waste? 17 A The annulus -- or annular system must be 18 monitored continuously for any potential loss of 19 annulus pressure, which would be an indicator either 20 of casing or a tubing leak above the packer. 21 Typically, specific gravity, pH, maximum wellhead 22 pressure are also monitored either continuously or on 23 a regular basis. 24 Annual waste treatment analysis for 25 wastestreams that do not vary are required to be</p>

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<p style="text-align: right;">Page 1069</p> <p>1 turned in with an annual report. And yearly 2 mechanical integrity testing is required of the well, 3 which involves both a radioactive tracer test, an 4 annulus pressure test and an ambient pressure 5 monitoring of the reservoir, which typically includes 6 a Fall-off test. And that's the primary monitoring 7 that goes on with an injection well -- Class I 8 injection well. 9 Q And I'm not an expert on these requirements 10 as you are, sir, but in my reading there was a 11 requirement that if the reservoir pressure was not 12 responding as predicted, based on these annual reviews 13 and reports then additional conditions could be placed 14 on the well, including shutting the well in until the 15 pressure comes back in line. Is that your 16 understanding? 17 A Not really. My understanding is that if 18 the -- if the maximum injection wellhead pressure is 19 exceeded above that which is permitted, the well has 20 to be shut in until -- well, it cannot be exceeded. 21 If it exceeds it, the well has to be shut in. And 22 then it can be turned back online once the pressure 23 decreases below that maximum, but it is not allowed to 24 be exceeded during operation. 25 Q I'm sorry, I misunderstood that requirement.</p>	<p style="text-align: right;">Page 1071</p> <p>1 this annual testing or annual Fall-off testing is 2 done. Is that your understanding? 3 A The well has to be shut in for the Fall-off 4 testing. That's part of the Fall-off testing. 5 Q And there is an annual requirement to conduct 6 a Fall-off test based on the provision we just -- you 7 just read. Is that correct? 8 A That is correct. 9 Q And if the results of that Fall-off test 10 showed a difference in the conservative assumptions 11 that were made in the application, what would be the 12 process of the TCEQ in addressing the difference in 13 the Fall-off test? 14 A I do not believe there is a vehicle for the 15 TCEQ to do anything about that after the permit is 16 issued as long as the maximum injection pressure -- 17 wellhead surface injection pressure is not exceeded 18 until the time of permit renewal comes up, which is 19 generally on a ten-year cycle. 20 At that point the accumulated Fall-off 21 test results would be presented in a permit renewal 22 application where the historical Fall-off tests would 23 be incorporated into a new model, and a demonstration 24 would be required that that model is conservative 25 based upon the historical Fall-off tests over the life</p>
<p style="text-align: right;">Page 1070</p> <p>1 The requirement then for Fall-off tests after the 2 initial Fall-off tests, could you describe those in 3 more detail? 4 A Typically, with the mechanical integrity 5 testing report, which gives the result of the annulus 6 pressure test, and the radioactive tracer test, the 7 results of the Fall-off test -- if it's performed at 8 the same time, and it's not required it be performed 9 at the same time but is typically included with that 10 report -- indicating what the calculated permeability 11 of that Fall-off test is. 12 Q Well, I'm going to call your attention again 13 to the same exhibit we were working with a moment ago, 14 Page 4 of 24. This time I'm looking at Section 8 -- 15 Roman Numeral VIII, Monitoring Tests Requirements, 16 Subsection (c). Do you find that? 17 A Yes, I do. 18 Q Could you read it into the record, please? 19 A "The pressure buildup in the injection zone 20 shall be monitored annually, including, at a minimum, 21 a shut down of the well for a sufficient time to 22 conduct a valid observation of the pressure Fall-off 23 curve." 24 Q Yeah, that's where I misunderstood the shut 25 down requirement. But the well can be shut down while</p>	<p style="text-align: right;">Page 1072</p> <p>1 of the well. 2 Q I'm sure you haven't had much experience in 3 TCEQ enforcement, but is it your testimony that if a 4 Fall-off test -- an annual Fall-off test indicated 5 that there was a greater cone of influence or that 6 there was an issue of endangerment that the TCEQ could 7 not address it until the ten-year renewal? 8 A Typically the cone of influence is not 9 recalculated with each year's Fall-off test analysis. 10 Just the permeability as -- or flow capacity is 11 presented in that Fall-off test report. I do not 12 believe that the TCEQ provides enforcement action 13 related to an anomalous Fall-off test permeability, 14 but provides enforcement action related to exceeding 15 the maximum wellhead injection pressure. 16 Q I understand. The cone of influence is 17 calculated on what timeline? My understanding -- do I 18 understand correctly that the cone of influence 19 contemplates 30 years of injection? 20 A Yes, the -- the application guidelines from 21 the TCEQ require that you model it out to the 22 projected life of the well, which the TCEQ has 23 stated -- not arbitrarily -- but has determined to be 24 a number to use of 30 years. 25 Q So if I understand correctly, the distances</p>

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<p style="text-align: right;">Page 1073</p> <p>1 that are calculated as part of the PRESS2 or BOAST98 2 modeling -- and you've given those earlier in your 3 testimony this afternoon -- those are distances of 4 pressure gradient, so to speak, after 30 years of 5 injection at maximum rates. Is that correct? 6 A For the pressure cone of influence? 7 Q Yes, sir. 8 A Yes, for 30 years. The waste plumes are, I 9 believe, 1, 10, and 30 years. 10 Q And I'm talking about pressure right now 11 because we'll go back to waste plume if necessary. 12 But for the pressure calculation, which is the issue 13 of concern for artificial penetrations, correct -- 14 A Correct. 15 Q So you're looking at -- when we talk in terms 16 of 750 feet or 3,170 feet, we're talking about where 17 that pressure will be after 30 years of injection, 18 correct? 19 A Where the cone of influence/endangerment 20 pressure, which in this case I believe is 421-psi 21 pressure increase, where that front lies within the 22 area of review after 30 years as presented in the 23 pressure model. 24 Q Okay. And you don't have any disagreement 25 with the calculation of the 421 psi. Is that correct?</p>	<p style="text-align: right;">Page 1075</p> <p>1 will be at a certain distance. But in the intervening 2 years between zero and 30 that endangerment pressure 3 or cone of influence gradually expands out to that 4 distance. 5 Q So again, in my simple terms, year one it's a 6 certain distance from the wellbore; year two -- the 7 421 mark I'm going with -- year two is a little farther 8 out, so on and so on, until you hit year 30 and that's 9 where this distance is defined? 10 A And in the permit application, yes, that is 11 correct. 12 Q Okay. Let's talk about the fault 4400 feet 13 to the southeast of the well. You're of the opinion 14 that the fault is not transmissive -- nontransmissive, 15 correct? 16 A I'm of the opinion it is nontransmissive 17 vertically and laterally. 18 Q Okay. So do you have in front of you TexCom 19 Exhibit 72? 20 (Discussion off the record) 21 MR. RILEY: We can substitute one into 22 the record. It wasn't marked or anything. It does 23 seem as though maybe Dr. Collier gathered it with his 24 belongings. 25 JUDGE EGAN: In that case, since we may</p>
<p style="text-align: right;">Page 1074</p> <p>1 A No, I do not. 2 Q And, I'm sorry, because sometimes it's just 3 not -- doesn't penetrate. Maybe it's late in the 4 afternoon. But when I begin -- or say I was to begin 5 injecting into an injection well as proposed in the 6 TexCom application, it's not as though on the first 7 day I inject, the pressure is felt 750 feet out from 8 the wellbore, correct? 9 A Well, there will be -- even with a low 10 permeability or a high permeability reservoir, there 11 will be a pressure effect or what I would call a 12 pressure transient that will project out a fairly 13 substantial distance within a fairly short period of 14 time. Not that that is going to be a 421-psi pressure 15 increase, but the reservoir permeability or the 16 interconnectedness of the pore space will transmit 17 that pressure out fairly quickly to some distance. 18 Q And, I'm sorry, because I keep trying to 19 think of things in simple terms, but eventually then 20 that 421-psi mark moves out over 30 years to the 21 boundary of the cone of influence as defined by the 22 two models that were run in this case? 23 A Yeah, that cone of influence is a moving 24 front -- if you want to put it that way -- in that 25 after 30 years, depending upon how you model it, it</p>	<p style="text-align: right;">Page 1076</p> <p>1 be substituting another copy for TexCom Exhibit No. 2 72, Mr. Gershon, feel free to loan him your copy in 3 the interim, if that's agreeable with everyone. If it 4 is, thank you. 5 MR. RILEY: It certainly is with us. 6 A There's to exhibit number on this. 7 Q (By Mr. Riley) I understand. That's because 8 the original has been -- has left the room it appears. 9 JUDGE EGAN: One of the witnesses 10 inadvertently picked it up -- 11 JUDGE WALSTON: You have the right 12 document. 13 WITNESS GRANT: This is the correct 14 document? 15 JUDGE EGAN: Yes. 16 Q (By Mr. Riley) Obviously, Mr. Grant, this is 17 not drawn to scale, but let's talk about the -- what 18 is depicted on this diagram as a fault to the right 19 side of the diagram. Do you see that? 20 A Yes, I do. 21 Q And in rough terms, would it correspond to 22 your understanding of the geology around the fault 23 that we've -- you've talked about just a moment ago, 24 the 4400-foot away fault that you say is 25 nontransmissive?</p>

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<p style="text-align: right;">Page 1077</p> <p>1 A If this is the fault that they -- as drawn on 2 here, if that's the 4400-foot fault, I do not know 3 whether it extends up above the Jackson shale or not 4 so I don't know if it's a true depiction of the fault 5 at shallower horizons, whether it extends higher or 6 not. But I do believe it does cut all of the 7 Cockfield, upper, middle and lower. 8 Q Okay. And with that clarification or 9 qualification, can we work with this diagram in 10 discussing the operation of that fault in the 11 Cockfield formation? 12 A We can. I believe the lower Cockfield is 13 about 300-plus feet, and to my recollection the offset 14 on this fault is somewhere between -- somewhere around 15 150 to 200 feet. So if I were drawing this, I would 16 show more of an offset here than what appears to be 17 potentially about 70 feet of throw on the fault. 18 Q All right. That's fair enough. 19 A But realizing it's not to scale, however . 20 Q Yes, and that's -- I don't want to bind you 21 to any distances or make any -- have you agree to 22 something that clearly I don't intend. It's simply a 23 diagram of a fault showing in rough terms the upper 24 Cockfield, a shale layer, the middle Cockfield, a 25 shale layer and a lower Cockfield without any</p>	<p style="text-align: right;">Page 1079</p> <p>1 juxtaposition across the fault; the second being 2 what's called shale smearing of the fault plain, both 3 of those, which provide a shale low permeability 4 barrier to both fluid movement laterally and 5 vertically and pressure movement laterally and 6 vertically. 7 Q Okay. So if I understood what you said 8 correctly, the -- the shale content -- and I'm not 9 trying to pin you down on shale content -- when this 10 fault occurred, the shale portion would have smeared 11 across the fault line. Is that your -- am I correct 12 in interpreting what you said? 13 A The -- yeah, it's not a one -- I don't 14 believe it would have been on any of these a one-time 15 event where the 150-foot of throw would have happened 16 instantaneously. But over geologic time, potentially 17 millions of years, this total amount of throw or 18 offset along the fault would have occurred. And along 19 that actual fault plain or -- it's sometimes called a 20 gouge zone -- it's a geologic term -- that the shales 21 or clays, because of their more putty-type 22 constitution, would have a tendency to be smeared 23 along that fault plain and provide a -- essentially a 24 seal, a shale-smear type of a seal. 25 Q Okay. Would that same theory apply to faults</p>
<p style="text-align: right;">Page 1078</p> <p>1 relationship to actual distances or even relative 2 thicknesses to those layers. Is that fair? 3 A That is correct -- or fair, yes. 4 Q All right. Now, again, with the other 5 qualification you had is you don't have any 6 information on whether the fault extends above the 7 Jackson shale, let's talk about how the fault would be 8 nontransmissive in your opinion. Can you explain how 9 you believe that a fault -- again, in gross terms -- 10 that's depicted in this diagram would be 11 nontransmissive as between the Cockfield sand? 12 A Additional detail within the middle and lower 13 Cockfield strata would show that probably close to 14 50 percent of each one of those are -- consist of 15 shale strata and the other 50 percent sand strata or, 16 in the lower Cockfield, approximately 145 feet of sand 17 to a total thickness of 300-something thickness. And 18 these sands and shales would be interbedded both in 19 the lower and middle Cockfield, meaning alternating 20 sand and shale strata as you move vertically up or 21 down the section. 22 My belief is this 23 greater-than-50 percent or approximately 50 percent 24 shale to sand ratio allows two mechanisms of sealing 25 along that fault, the first being a sand-to-shale</p>	<p style="text-align: right;">Page 1080</p> <p>1 of a lesser throw or offset? 2 A Yes, it potentially could. 3 Q The sealing feature you describe seems to be 4 somewhat at odds with Dr. Collier's testimony that all 5 faults are transmissive -- and I mischaracterized it a 6 little bit -- that some faults are transmissive. How 7 do you justify those two different opinions? 8 A Well, I believe the -- the document he was 9 referring to in the -- in his testimony was an Exxon 10 document talking about the entire Conroe oil field set 11 of faults, and that some of them were laterally and/or 12 vertically transmissive. 13 I did not review all the faults, 14 particularly the ones that were outside of the cone of 15 influence, but I do believe that within the Conroe 16 field there would be places where the faults could -- 17 as evidenced or as presented by Exxon -- could be 18 laterally or vertically transmissive. However, I do 19 not believe this specific fault is. 20 Q Okay. And, Mr. Grant, I want to understand 21 all your reasons for believing this fault to be 22 nontransmissive. Other than your general description 23 of the stratum -- or strata, I suppose -- which would 24 seem to be true no matter where a fault occurred in 25 the Cockfield, that they are all consistently sand</p>

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<p style="text-align: right;">Page 1081</p> <p>1 shale layers, how would you distinguish this fault 2 from other faults in the Cockfield? 3 A Some of the faults in the Cockfield do not -- 4 based upon the Exxon mapping -- do not provide a 5 hydrocarbon trap. This fault provides a hydrocarbon 6 trap where the upper Cockfield sands provide -- are 7 reservoirs higher up in the section. The middle and 8 lower Cockfield are apparently barren of oil and gas, 9 but the upper Cockfield provide -- has hydrocarbon 10 trapping. And the mechanism for that would have to be 11 a sealed fault, because it's not a four-way closure 12 structurally. 13 However, it is -- the hydrocarbons 14 appear to be nestled up -- to use a non -- to use a 15 layman's term -- but to be nestled up against the 16 fault plain and appear to have stopped as they 17 migrated laterally and up -- the slight structure up 18 towards the dome would appear to have been stopped by 19 the fault plain and form a trap that was later 20 produced by Exxon and other operators in the field. 21 Q And that was only in -- with respect to the 22 upper Cockfield, correct? 23 A As far as I know, there's no lower and middle 24 Cockfield production; however, I do not believe that 25 means that the middle and lower Cockfield sections</p>	<p style="text-align: right;">Page 1083</p> <p>1 Q All right. So with all your diligence and 2 all your review, you did not find hydrocarbon 3 production in the nontransmissive area between the 4 lower Cockfield and the middle Cockfield, or between 5 the middle Cockfield and the upper Cockfield, correct? 6 A Not along this specific fault, no. 7 Q Now, what is an attic? Do you know the term 8 "attic" when referring to a fault in production of 9 hydrocarbons? 10 A Yes, I do know what an attic is. 11 Q What is it? 12 A It's an area similar to an attic where you 13 would have faults -- or where you would have 14 hydrocarbons trapped. 15 Q Would you agree with me that a prime 16 opportunity for a hydrocarbon trap in the diagram that 17 we're looking at here, given that the upslope to these 18 formations is toward the -- to the right of the 19 paper -- that a hydrocarbons attic would most likely 20 form between the Jackson and the upper Cockfield at 21 the fault. Would you agree? 22 A Yes, I do agree with that. 23 Q So the fact that there's oil production on 24 the northwestern side of the fault could be due to an 25 attic formed by the Jackson shale, correct?</p>
<p style="text-align: right;">Page 1082</p> <p>1 along that fault are transmissive. I do believe that 2 the lower and middle Cockfield sands did not have -- 3 at this location and the fault block did not have 4 hydrocarbons that ever migrated through them to come 5 up against that fault and form a hydrocarbon. 6 Q So, for instance, on the diagram, if we 7 looked at the shale layer between the middle Cockfield 8 and the upper Cockfield and the offset barrier there 9 that you claim would be nontransmissive, no 10 hydrocarbons have ever been found in that barrier in 11 the middle Cockfield. Is that correct? 12 A Not that I have found on any of the maps that 13 I have reviewed. 14 Q Same question regarding the lower Cockfield 15 and the middle Cockfield, no hydrocarbons have been 16 produced from that nontransmissive area, if you're 17 correct? 18 A Not that I have found. 19 Q So the solely productive zone would be -- 20 would still be the upper Cockfield, correct? 21 A As far as what I have found in the Exxon 22 hearing files, correct. 23 Q And I assume you were diligent in your 24 review, were you not? 25 A Yes, I believe I was.</p>	<p style="text-align: right;">Page 1084</p> <p>1 A It could be. However, it appears that the 2 gas and oil column is greater than the amount of 3 the -- of what you would call attic at that position. 4 Q Let's talk about in its virgin state. Do you 5 know what I mean when say -- when I talk to or speak 6 to virgin information? 7 A Yes, regarding a virgin oil reservoir and gas 8 reservoir before it's been produced? 9 Q Yes, sir. 10 A Yes. 11 Q Tell me what the well information was on 12 either side of the fault in its virgin state, if you 13 know. 14 A What do you mean by the well information? 15 Q Well, I believe there's a point in time -- 16 and it seems rather arbitrary in my mind -- where one 17 determines -- or geologists in particular, maybe 18 petroleum geologists in particular -- determine how 19 the reservoir -- what was in the reservoir at this 20 virgin time or at this point in time called the virgin 21 production. Do you understand what I'm saying? 22 A Yes, I do. 23 Q And that means that when the field is first 24 discovered and wells are produced on either side of a 25 fault, there are observations made regarding the</p>

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<p style="text-align: right;">Page 1085</p> <p>1 levels or the depths to which oil and gas appear, 2 correct? 3 A Yes. 4 Q Okay. And do you know what the information 5 available in the Exxon records and other places 6 indicates regarding the -- this fault as it pertains 7 to the levels of oil and gas production -- or where 8 oil and gas was found on either side of the fault? 9 A No, I just have the structure map showing the 10 upper Cockfield, various horizons in the upper 11 Cockfield showing the -- a plainer view of the trap. 12 Q So my point is that if -- if it were shown 13 that the pressures or the -- I'm sorry, I think it is 14 the -- it is done by depth to the zone -- depth to 15 gas, depth to oil, depth to water. Is that indicative 16 of transmissivity across the fault or connectivity 17 across the fault? 18 A I'm not exactly sure what you mean. 19 Q Okay. I thought you had said a moment ago 20 that the fact that -- and I don't think I'll be able 21 to recall your words -- that you saw differences in 22 the -- well, let me ask you to repeat it because that 23 would be probably a lot easier and quicker. 24 What is it about the oil and gas 25 production that lead you to conclude that the fault</p>	<p style="text-align: right;">Page 1087</p> <p>1 where I think petroleum geologists would say, "These 2 are the characteristics of the reservoir before it is 3 altered by production." Am I somewhere in the 4 neighborhood of what virgin state means? 5 A Yeah, that would appear to be correct. 6 Q All right. And would, for instance, that the 7 oil level or where you would find oil, the depth to 8 oil, if it were the same on either side of the fault, 9 would that indicate anything in your mind regarding 10 the transmissivity of the fault below the attic? 11 A I think it would be inconclusive as to what 12 it demonstrated. 13 Q Would you not agree that it is more likely 14 than not that if, before anything is produced out of 15 reservoir, that if I find oil at the same depth on one 16 side of a fault as I do on the other side of a fault, 17 that it is likely due to connectivity -- or 18 connectivity between those two underground reservoirs? 19 A No, I wouldn't agree with that. 20 Q As a reservoir is produced, presumably the 21 water level rises and the oil level rises with it -- 22 or the oil level rises and the water comes up behind 23 it, correct? 24 A As what is produced? 25 Q I'm sorry, as oil or gas is produced off the</p>
<p style="text-align: right;">Page 1086</p> <p>1 was not transmissive? 2 A Because it was trapped up against the fault 3 where laterally it did not migrate across the fault. 4 Q And I think we talked about that could be due 5 to an attic, correct? 6 A Yes, we did. 7 Q In this particular case it would seem, given 8 that the upslope side is to the right-hand side of the 9 paper, it would be a prime opportunity for creation of 10 an attic in the upper Cockfield? 11 A That is correct. 12 Q So it could not -- it doesn't necessarily 13 mean that the entire fault is nontransmissive. It 14 means that an attic in the upper Cockfield could exist 15 and the hydrocarbon production could occur in that 16 area? 17 A Yes, that is possible. 18 Q Now, I was going back to before the reservoir 19 was produced, I guess, in significant quantities over 20 the course of the Conroe field. You would agree with 21 me that the oil and gas reservoirs have been tapped 22 over the course of the last 70 years or so, correct? 23 A Yes, I would agree with that. 24 Q And in its virgin state -- again back to that 25 portion of our discussion -- there's a point in time</p>	<p style="text-align: right;">Page 1088</p> <p>1 top of the formation. 2 A If the oil is produced, the gas cap could 3 expand and potentially push the oil/water content 4 downward. Vice versa, if the gas cap is produced, the 5 water drive would potentially move the oil/water 6 contact upward, depending upon which reservoir is 7 produced. And, of course, if there's a lot of fault 8 block, each might act independently of each other 9 depending upon the rate at which they were produced 10 and which hydrocarbon was produced. 11 Q Would that -- would a fault block -- well, 12 given what you just said, the last portion of your 13 answer, if indeed there wasn't transmission out of a 14 fault block, wouldn't you expect them to behave 15 differently? In other words, if they're not 16 connected, they should not behave the same, correct? 17 A What should not behave the same? 18 Q Well, you're producing out of a well on one 19 side of a fault. You're producing out of a well on 20 the other side of a fault. So far okay? 21 A Okay. 22 Q And if the reservoir is behaving in a similar 23 fashion on each side of the fault, would you expect it 24 to be transmissive or nontransmissive? 25 A It could be either due to transmissivity or</p>

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<p style="text-align: right;">Page 1089</p> <p>1 similar production rates on both sides of the fault by 2 those two wells. 3 Q All right. What I'm imagining is in this 4 fault zone, across the fault, a pool of oil. Are you 5 with me so far? 6 A Yes. 7 Q And I'm not up to the part where the oil has 8 risen to a level where it is exclusively in the attic 9 on, let's say, the northwest side and exclusively in 10 the formation on, say, the southeast side. So far 11 okay? 12 A Yes. 13 Q So while that reservoir is being depleted or 14 withdrawn, you would expect it to behave similarly 15 across the fault if it's transmissive. Is that 16 correct? 17 A Depending upon the -- if it is transmissive, 18 depending upon the level of transmissivity it might 19 continue to balance or it might not. 20 Q Okay. So if it's a high permeable layer, say 21 1 darcy, can you draw any conclusion knowing the 22 permeability of the upper Cockfield as somewhere in 23 the order of 1 darcy or above? 24 A I don't know that that's a fact. I have no 25 indications what the permeability of the upper</p>	<p style="text-align: right;">Page 1091</p> <p>1 potential of this specific fault at the lower 2 Cockfield level. 3 Q All right. The ceiling nature of the fault 4 that you've focused on -- or that we've been 5 discussing. I shouldn't say you focused on. Do you 6 have any evidence that you can present here in this 7 case that indicates it is nontransmissive other than 8 the general characteristics of the sands we've been 9 discussing? 10 A The general characteristics of the sand, the 11 50 to 60 percent shale and 50 -- 40 percent sand 12 within the lower and middle Cockfield are the -- and 13 the amount of throw on the fault of 150 feet are, in 14 my geologic -- in my geologic experience -- is 15 indicative that that fault is very likely laterally -- 16 JUDGE EGAN: Is laterally? 17 WITNESS GRANT: Yes, laterally and 18 virtually sealed. 19 JUDGE WALSTON: Sealed? 20 WITNESS GRANT: Sealed, sealing, or a 21 no-flow boundary, a pressure boundary. 22 Q (By Mr. Riley) And again, to a layperson 23 maybe this is -- just doesn't seem logical to me, 24 maybe it's not to everybody else, but the -- why 25 wouldn't this same analysis apply to any fault that is</p>
<p style="text-align: right;">Page 1090</p> <p>1 Cockfield is. 2 Q Well, assume with me for a second that it is 3 one darcy. Would the phenomena I was trying to 4 describe be more likely in a permeability of one 5 darcy? 6 A If there was no -- no shale smearing or sand 7 to shale contact across the fault, it would be more 8 likely that the levels would stay the same on both 9 sides of the fault, assuming all your other -- with 10 all your other assumptions. 11 Q All right. Did you look at that information? 12 Did you look at the virgin state of the reservoir as 13 available in the Railroad Commission records? 14 A I did not see anything related to virgin 15 pressures in the reservoir. 16 Q Would that help you in making a -- or forming 17 an opinion as to whether the fault we've been 18 discussing is transmissive or not transmissive? 19 A Not related to the lower Cockfield. It would 20 make an opinion related -- it would affect -- not 21 affect -- it would give an indication of lateral 22 transmissivity potential across the upper Cockfield 23 assuming all the production data on both sides of that 24 fault could be provided. Short of that, it wouldn't 25 necessarily give an indication as to the sealing</p>	<p style="text-align: right;">Page 1092</p> <p>1 identified in the upper, middle or lower Cockfield? 2 A Well, because the lower and the middle 3 Cockfield have more shale percentages than the upper 4 Cockfield -- not by a really huge amount, but they 5 tend to be dirtier or less clean sand in the middle 6 and lower as evidenced by previous testimony of higher 7 permeability in the upper and medium and lower 8 permeability in the middle and lower Cockfield. 9 Q Well, let me ask you a question then being 10 specific to the middle and lower. Why wouldn't the 11 same analysis apply to any fault found in the middle 12 or lower Cockfield, that it is -- since it's such a 13 high shale content -- that any faulting in those 14 layers would form nontransmissive faults both 15 laterally and vertically? 16 A And I can only speak for the one fault that I 17 have reviewed in detail, which is this fault, not all 18 the faults in the Conroe oil field. But to this 19 specific fault it would seem to me to be a strong 20 indicator that it is laterally sealed. 21 Q What about vertically sealing? 22 A Yes, I believe it's vertically sealing. 23 Q Okay. Now, other than the throw -- or the 24 offset as we've been calling it -- what other 25 information do you have about that fault that makes it</p>

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<p style="text-align: right;">Page 1093</p> <p>1 unique in terms of how you analyzed the available 2 information? 3 A There's nothing else that makes it unique. 4 Q Okay. So the shale content and the throw or 5 offset are all that you're drawing on to say that it's 6 vertically and laterally sealing? 7 A Also my general knowledge that if you've got 8 at least 30 to 40 percent shale in the tertiary 9 section of the Gulf Coast you generally have a sealing 10 mechanism -- or you often have a sealing mechanism 11 laterally on a fault. 12 Q Let me ask you a question about the number of 13 oil wells that are depicted on a number of different 14 diagrams, but there's a good number of oil wells that 15 were to the south and east -- excuse me -- yeah, south 16 and east of the fault -- the fault that we've been 17 discussing -- and fewer to the north and west. 18 A Correct. 19 Q Does that indicate that there's less oil and 20 gas production from the north and west on the -- as it 21 pertains or as it relates to the fault? 22 A No, it appears to me to indicate that as you 23 reach the crest of the structure on the deep-seated 24 salt feature at the Conroe field that the faulting 25 becomes much more closely spaced or prevalent than out</p>	<p style="text-align: right;">Page 1095</p> <p>1 JUDGE EGAN: Hold on. I couldn't hear 2 his last answer. 3 MR. RILEY: I'm sorry, Judge. 4 JUDGE EGAN: I'm losing -- the very end 5 is -- you fade out. What was the last part of what 6 you said? 7 THE REPORTER: I was trying to stop you, 8 too. 9 WITNESS GRANT: I did not use 500 10 millidarcies in my pressure model. I used 81 11 millidarcies because I believed that 81 millidarcies 12 was more a appropriate value for permeability. 13 Q (By Mr. Riley) But it's only an appropriate 14 value, Mr. Grant, if in fact the TCEQ would not 15 require the applicant to demonstrate that 500 16 millidarcies is conservative in its modeling and 17 submitted with this application? 18 A It appears that the TCEQ has not -- has 19 accepted 500 millidarcies as appropriate in that they 20 have -- in the pressure modeling in that they have 21 issued a draft permit with 500 millidarcies in the 22 pressure model and discounted the actual measured 23 average permeability for the perforated interval as 24 presented in the completion report for WDW-315. 25 Q But we're not going to inject into WDW-315 as</p>
<p style="text-align: right;">Page 1094</p> <p>1 on the flanks of the field. 2 Q All right. The difference and the 3 distinction in all this discussion really is that you 4 modeled the 14 -- or 4400-foot fault as a pressure 5 barrier -- correct? -- using the PRESS2 model? 6 A That is correct. 7 Q Did you do any modeling using 500 8 millidarcies in the PRESS2 model? 9 A Did I do any modeling -- no. 10 Q If you did modeling using 500 millidarcies as 11 your permeability, even if you assumed the fault to 12 the southeast, the one we've been discussing, to be a 13 pressure barrier, what is your cone of influence? 14 A I don't know what the cone of influence would 15 be with 500 millidarcies. 16 Q So your cone of influence that you calculated 17 at some 14,000 feet assuming the fault to be 18 nontransmissive is not relevant to an analysis 19 assuming the permeability to be 500 millidarcies, 20 correct? 21 A Not if it's 500. 22 Q So that -- 23 A But I do not believe -- I did not run it with 24 500 millidarcies because (inaudible) 25 Q I know you believe that, but we discussed --</p>	<p style="text-align: right;">Page 1096</p> <p>1 currently perforated. You understand that? 2 A I have no -- 3 Q You just read special conditions -- 4 A -- does not appear to be any -- am I speaking 5 loudly? 6 JUDGE EGAN: Yeah, you can go ahead. 7 A -- does not appear to be any guarantees or 8 requirements in the draft permit as currently written 9 that specifically requires TexCom to do those things 10 as the applicant states they will. 11 Q Take a look at Page 6 of 24 -- we covered it 12 earlier -- and the special condition letter G. I'll 13 read it to you while you're looking, just make sure I 14 read it correctly: "This permit is based on, and the 15 permittee shall follow, the plans and specifications 16 contained in the Class I underground injection control 17 application dated July 29th, 2005 as revised," and 18 then it gives a number of dates, "which is hereby 19 approved subject to the terms of this permit and any 20 other orders of the TCEQ." 21 What about that is ambiguous in your 22 mind as to whether the applicant must recomplete the 23 well across 145 feet in the lower Cockfield zone? 24 A It's ambiguous because it does not 25 specifically state that in there, and I believe that</p>

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<p style="text-align: right;">Page 1097</p> <p>1 that is not clear enough direction to the applicant as 2 to what they would have to do once the permit is 3 issued. 4 JUDGE EGAN: I believe, Mr. Riley, 5 you've covered this territory. 6 MR. RILEY: Thank you, Your Honor . 7 Q (By Mr. Riley) If the applicant demonstrates 8 that the permeability is 500 millidarcies based on 9 the -- your assumption that the fault to the south -- 10 southeast is nontransmissive, what is the cone of 11 influence? 12 A I do not know what the cone of influence 13 would be based upon 500 millidarcies and a 14 nontransmissive fault to the south. 15 Q Would it be -- 16 A I do -- 17 Q Please continue. 18 A And the BOAST model as currently presented 19 not only provides a thickness of 145 feet, but 20 laterally to the south increases it to 401 feet, which 21 is obviously not the scenario of a no-flow boundary. 22 Q Well, I hear you, and that's not my question. 23 You made it very clear that you think that the fault 24 should have been modeled as a pressure boundary. And 25 you also made it very clear that you used 81</p>	<p style="text-align: right;">Page 1099</p> <p>1 nontransmissive fault for WDW 411? 2 A I do not know what it would be because I 3 cannot tell you at this point what the thickness 4 perforated would be. Therefore, it would directly 5 affect the cone of influence, and I do not know that 6 500 would be -- millidarcies would be the result of a 7 Fall-off test for those other wells. 8 Q Sir, in each of your applications, the ones 9 you've sponsored -- and I think the word is marshaled 10 through the process in your prefiled testimony -- you 11 don't have Fall-off test data for those wells, do you? 12 A No, I do not, not typically. 13 Q Okay. So that would be more typical of 14 WDW-411, correct? That would be exactly the same 15 situation? 16 A That is correct. 17 Q So in your instance and the instances you've 18 actually represented a permit applicant and assisted 19 them with their permit application, what have you 20 used? How have you determined permeability in those 21 instances? 22 A Before or after the well is drilled? 23 Q Well, before. I'm talking about a fresh, new 24 greenfield as we might refer to it where you're going 25 to put a Class I nonhazardous injection well. Are we</p>
<p style="text-align: right;">Page 1098</p> <p>1 millidarcies and you're not confident the applicant 2 would have to demonstrate any different permeability 3 to the TCEQ before injecting waste into WW-315. 4 But what about the other wells, sir? 5 Are you convinced that the TCEQ requirements, 6 regardless of your opinion about WDW-315 or future 7 WDW-410 -- are you convinced at least the other wells, 8 the other three proposed wells, would be required to 9 demonstrate that 500 millidarcies was conservative? 10 A I don't know if -- what the other wells, once 11 they were completed, would come up with as far as a 12 permeability once they are completed, but it would be 13 my opinion that the permeability is demonstrated 14 during the Fall-off testing as part of the completion 15 of those wells would be inputs -- or required to be 16 submitted to the TCEQ for review for conservativeness 17 of those -- of the pressure model for those wells. 18 Q Let's talk WDW-411. 19 A All right. 20 Q Which would have a permeability of 500 21 millidarcies demonstrated by a Fall-off test under 22 your very last answer, correct, in order to pass TCEQ 23 post-drilling review, correct? 24 A Correct. 25 Q What is the cone of influence assuming a</p>	<p style="text-align: right;">Page 1100</p> <p>1 together so far? 2 A Yes. 3 Q Is that analogous to any of the other three 4 wells WDW-411, WDW-412, and WDW -- I hope it's 413. 5 A It is analogous to those other ones, yes. 6 Q All right. So in no way does the TexCom 7 application -- is it different from applications 8 you've handled where you have not had Fall-off test 9 data for new wells, correct, or new proposed wells? 10 A It is different in that there is wells -- one 11 well exceedingly close that does have Fall-off test 12 data for the same reservoir that 411, 412 and 413 have 13 proposed for injection into. 14 Q Sir, are you required to do a Fall-off test 15 for each well you propose? 16 A Yes, I am. 17 Q Okay. So again, the Fall-off test and the 18 available data for WDW-410 is not relevant for my 19 questions regarding 411, 412 and 413. Would you 20 agree? 21 A No. It is relevant as far as the preliminary 22 modeling that you would do before you drilled the 23 well. You would use the most closest site-specific 24 permeability that you could to generate your pressure 25 model.</p>

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<p style="text-align: right;">Page 1101</p> <p>1 Q So you're saying that the applicant, because 2 it has a well with 81 millidarcies from a Fall-off 3 test completed in a different interval than what it's 4 proposing is bound to 81 millidarcies for all purposes 5 in modeling the new wells? 6 A Before the wells are drilled my belief is 7 that it should be using 81 millidarcies until that can 8 be either proven up or proven to be not correct. 9 Q Well, it's going to be relatively difficult 10 to do that unless the new zone is perforated under 11 this permit and it is evaluated for permeability in a 12 Fall-off test and reviewed by the TCEQ. Wouldn't you 13 agree? 14 A I would agree. 15 Q So presumably then you would agree that the 16 permit should be issued; that the Fall-off tests 17 should be done, both in the existing well and any 18 future wells that are drilled; and that those 19 assumptions should be evaluated against -- excuse me, 20 those results should be evaluated against the 21 assumptions made in the modeling to determine whether 22 the modeling was conservative? 23 A For the three undrilled wells, I agree with 24 that. For the currently-drilled well I do not believe 25 the safeguards are in place.</p>	<p style="text-align: right;">Page 1103</p> <p>1 JUDGE EGAN: All right. Why don't you 2 take a moment and review your notes, but it's not 3 necessary to go back over material we already have the 4 answers to. 5 MR. RILEY: Thank you. 6 (Recess: 4:32 p.m. to 4:45 p.m.) 7 JUDGE EGAN: Is everybody ready to get 8 back on the record? We were still in cross. You may 9 proceed, Mr. Riley. 10 MR. RILEY: Thank you, Your Honor. 11 Q (By Mr. Riley) At the risk of aggravating 12 certain folks in the room, let me just ask you some 13 questions from your sworn deposition. By the way, I 14 took your deposition in this case on November 28th, 15 2007, correct? 16 A I believe that's the case, although I'd have 17 to check my own records as far as the date. 18 Q Have you reviewed the transcript and have you 19 signed the deposition? 20 A I have. 21 Q And were the answers in that deposition that 22 you gave to my questions truthful? 23 A To the best of my knowledge and intent they 24 were. 25 Q I'm referring to Page 65, Line 10 of that</p>
<p style="text-align: right;">Page 1102</p> <p>1 Q The safeguards in place would just be a 2 condition that said, "Treat this as a new well, do a 3 new Fall-off test after you've reperforated in the 4 interval that you propose and send us the data and 5 we'll tell you whether you can accept waste or not," 6 correct? 7 A Assuming that that Fall-off test also went 8 out a radius of investigation to determine whether the 9 fault to the south was laterally a pressure boundary 10 or not. 11 Q So you would want a -- 12 JUDGE EGAN: Mr. Riley, some of these 13 questions are getting very repetitive. I know the 14 answers at this point and I believe Judge Walston 15 knows the answers. 16 MR. RILEY: I'm trying just to get the 17 answers from the witness, Judge. 18 JUDGE EGAN: Well, the witness has 19 already given you the answer. He's not going to agree 20 with you no matter how many different ways you ask it. 21 Why don't we take a short 10-minute 22 break and come back at quarter til 5:00, and -- 23 MR. RILEY: I think I will probably be 24 done at that point, Judge, but I will have to review 25 my notes just briefly.</p>	<p style="text-align: right;">Page 1104</p> <p>1 deposition. I'm going to read to you and tell me if 2 you remember being asked these questions and giving 3 these answers, Page 65, Line 10: "Question: So in 4 fact if you were right that 81 millidarcies is the 5 right value after the well is completed in the 6 interval proposed, after all that drilling and testing 7 is done, what would happen? 8 "Answer: They would have to redo their 9 pressure model --" 10 I interrupted inadvertently with "Okay." 11 You continued "-- to either demonstrate 12 that there is not an endangerment issue with that 13 lower pressure or would potentially have to go into 14 abandoned artificial penetrations that penetrated the 15 injection interval and replug them. 16 "Question: So the system takes care of 17 that, takes care of the miscalculation in the modeling 18 submitted as part of the permit application." 19 Your answer: "Yes, it should." 20 "Question: All right. Is there any 21 reason you have to doubt that that would be the 22 process followed in this case? 23 "Answer: No." 24 Were those answers truthful to the 25 questions I asked you at your deposition?</p>

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<p>1 A Yes, they were.</p> <p>2 Q One more set of questions on a different</p> <p>3 topic in your deposition, then I believe I'll be</p> <p>4 through. This was in -- regarding the public interest</p> <p>5 aspect of your work in developing UIC permit</p> <p>6 applications. Do you recall a series of questions</p> <p>7 regarding public interest?</p> <p>8 A I'm sure I will when you read them.</p> <p>9 Q Again, it's on Page 85, Line 1 of the</p> <p>10 deposition.</p> <p>11 "Question: And is it your opinion that</p> <p>12 it is a safe method of waste disposal?</p> <p>13 "Answer: Yes."</p> <p>14 Do you recall that being -- referring</p> <p>15 underground injection control as a method of waste</p> <p>16 disposal.</p> <p>17 A I believe so.</p> <p>18 Q "Question: In the applications that you've</p> <p>19 prepared, have you demonstrated in each occasion that</p> <p>20 the application is in the public interest?</p> <p>21 "Answer: I believe I have.</p> <p>22 "Question: And how have you done that?</p> <p>23 "Answer: Through the technical report</p> <p>24 and demonstrations within the technical report</p> <p>25 demonstrating the safety of injection in that specific</p>	<p>1 this specific location is appropriate. Can you</p> <p>2 distinguish between those two?</p> <p>3 A Suitable meaning the reservoirs there which</p> <p>4 would accept fluid, appropriate in that I'm concerned</p> <p>5 about the pressure increase due to injection and the</p> <p>6 potential for artificial penetrations to serve as</p> <p>7 conduits of fluid out of the injection zone into</p> <p>8 the -- into a USDW unless certain concerns I have</p> <p>9 related to the application are addressed to my</p> <p>10 satisfaction.</p> <p>11 Q To your knowledge of the TCEQ UIC rules, is</p> <p>12 there a provision for appropriateness of an injection</p> <p>13 zone?</p> <p>14 A I'm not exactly sure what you mean by</p> <p>15 appropriateness.</p> <p>16 Q Is "appropriate" as you have used the word in</p> <p>17 your prefiled testimony defined or used in TCEQ rules?</p> <p>18 A Yes, I believe they do have in their review</p> <p>19 of a permit application -- have that requirement to</p> <p>20 determine appropriateness.</p> <p>21 Q And under -- in what context is it used?</p> <p>22 Appropriate as to the --</p> <p>23 A To location on the surface, to subsurface</p> <p>24 strata in which to inject, to defining operating</p> <p>25 parameters and permit pressure and flow maximums and</p>
Page 1106	Page 1108
<p>1 location.</p> <p>2 "Question: Now, I think -- at least as</p> <p>3 best I read your testimony and heard your testimony</p> <p>4 today -- as best I am humanly capable of doing that --</p> <p>5 you have no objection to the -- from a subsurface</p> <p>6 geological perspective -- to an injection well</p> <p>7 completed in the sand that's proposed in this</p> <p>8 application. Is that correct?"</p> <p>9 "Answer: That is correct."</p> <p>10 Do you remember being asked those</p> <p>11 questions and did you give those answers --</p> <p>12 A I believe that is correct.</p> <p>13 MR. RILEY: Thank you, Mr. Grant. I</p> <p>14 have no further questions.</p> <p>15 JUDGE EGAN: Mr. Williams?</p> <p>16 CROSS-EXAMINATION</p> <p>17 BY MR. WILLIAMS:</p> <p>18 Q Good afternoon, Mr. Grant.</p> <p>19 A Good afternoon.</p> <p>20 Q You say in your prefiled testimony that you</p> <p>21 believe the area is geologically suitable for</p> <p>22 underground injection of industrial solid waste. Is</p> <p>23 that correct?</p> <p>24 A That is correct.</p> <p>25 Q But you also further say you don't believe</p>	<p>1 other technical issues.</p> <p>2 Q Okay. Have all of the UIC applications that</p> <p>3 you've worked on in the past been for new wells?</p> <p>4 A No, sir. Some of them have been for permit</p> <p>5 renewals or permit amendments of existing wells.</p> <p>6 Q Have you ever converted a previous well to a</p> <p>7 Class I?</p> <p>8 A No, I have not -- you mean like an oil and</p> <p>9 gas well to a Class I or --</p> <p>10 Q Any kind of conversion.</p> <p>11 A Not that I can remember.</p> <p>12 Q Well No. 315 exists, right?</p> <p>13 A That is correct.</p> <p>14 Q Is it currently permitted?</p> <p>15 A I do not believe the current 315 permit is</p> <p>16 active at this point.</p> <p>17 Q So --</p> <p>18 A -- I'm sorry.</p> <p>19 Q That's okay. Go ahead and finish.</p> <p>20 A And the 410 permit application has -- is in</p> <p>21 draft permit stage.</p> <p>22 Q So we have a well that is in existence but</p> <p>23 not permitted. And it -- and the applicant is</p> <p>24 applying for a new permit for that well, correct?</p> <p>25 A That is correct.</p>

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<p style="text-align: right;">Page 1109</p> <p>1 Q Then why would there be anything less than a 2 completion report required? 3 A Because the applicant has already provided 4 the completion report for the well as previously 5 presented under the 315 drilling and completion. So I 6 do not anticipate an additional completion report to 7 be filed for 410. 8 Q If it were clear that the TCEQ would require 9 a full, complete new completion report for 410, would 10 that allay your fears? 11 A That would -- and all the -- all the 12 accompanying requirements as -- of a new well, 13 including incorporating the results of either the 14 current Fall-off test or revised Fall-off test, if it 15 was done, were included in that completion report and 16 demonstrated that the modeling as currently presented 17 is conservative -- or remodeling presented to show a 18 new cone of influence and addressment of wells within 19 that revised cone of influence of essentially -- and a 20 determination of the fault being either laterally a 21 pressure boundary or not. That would significantly 22 allay my concerns about this application. 23 Q So you would agree that a recalculation of 24 the area review and the cone of influence is normally 25 done on a new well as part of the completion report.</p>	<p style="text-align: right;">Page 1111</p> <p>1 Q And was it permitted? 2 A Yes, it was. 3 Q Have you ever -- have you ever completed a 4 Class I well and the permeability Fall-off -- the 5 Fall-off test indicated a permeability higher than 6 what you had modeled? 7 A Yes, I have. 8 Q And did the applicant or TCEQ immediately 9 increase the amount of fluids that can be injected? 10 A No. They assumed that the -- in my case 11 anyway -- that the modeling was conservative and left 12 the operating parameters the same. 13 Q On the other hand, if you -- if you complete 14 the Fall-off test and determine a permeability less 15 than what you modeled, TCEQ demands that it be, you 16 know, scaled back. Is that correct? 17 A They required that I present a new pressure 18 model, and they determined certain operating 19 parameters as to be lower or more conservative as a 20 result of that. 21 Q But the overall effect of that is that 22 there's less waste that can be disposed of -- is that 23 correct -- through that well because of the lower 24 permeability? 25 A It can be less waste, or it could be a lower</p>
<p style="text-align: right;">Page 1110</p> <p>1 Is that correct? 2 A Yes, that is -- that is typically the case. 3 Q Good. In your experience with underground 4 injection control permits that you have worked on, 5 aren't TCEQ rules in Chapter 331 incorporated into the 6 permit? 7 A I believe they are. 8 Q And so if the rules were to be interpreted as 9 requiring a full completion report on this kind of 10 strange animal -- the conversion of an existing well 11 previously permitted to a new permit -- then it would 12 include all those other things -- the calculation, the 13 area of review and the cone of influence, correct -- 14 and a new Fall-off test? 15 A If that were incorporated in specifically -- 16 and not just by rule -- but the specific checklist of 17 issues that I have brought up, I would be -- I would 18 feel that was -- 19 Q More comfortable? 20 A Right. I would be more comfortable with 21 that, yes. 22 Q Have you ever -- on any of the permits that 23 you were involved in in the past, have you ever 24 modeled a Class I well with this low permeability? 25 A Yes, I have.</p>	<p style="text-align: right;">Page 1112</p> <p>1 maximum surface injection -- flowing injection 2 pressure. 3 Q But if there's less pressure, then there's 4 less going down. That correct? Is that safe to say? 5 A If you don't reach your maximum wellhead 6 pressures with a similar rate, then you could 7 potentially inject the same amount. You would just 8 have a -- less of a range of wellhead pressures to 9 work with. 10 Q Okay. 11 A Maximum -- less of a maximum wellhead 12 pressure to bump up against. 13 Q But in your experience, based on the Fall-off 14 tests, if it's higher than what you modeled, the TCEQ 15 will not let you automatically have extra pressure to 16 put down the well. But if it's lower than what you 17 modeled, they will require cutting back on the various 18 aspects that you mentioned. Is that correct? 19 A They won't -- 20 Q -- to be more conservative? 21 A They won't require or they will require? 22 Q Let me rephrase. If you do the Fall-off test 23 and the permeability is greater -- higher than what 24 you had modeled -- 25 A Yes.</p>

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<p style="text-align: right;">Page 1113</p> <p>1 Q -- you're not automatically given the 2 opportunity to increase the amount of waste that 3 you're disposing or increase pressure or put more 4 underground. You have to stick with what you applied 5 for. Is that correct? 6 A Typically that is the case. 7 Q But if it's less, if the Fall-off test 8 pressure is less, then you're required to be more 9 conservative. Is that correct? 10 A Typically you are required -- or they -- the 11 TCEQ will require you to change some of your operating 12 parameters to stay within that new calculated 13 pressure. 14 Q And based on your Fall-off tests, if it's 15 less than what you had originally calculated or 16 modeled, aren't you also required to change and adjust 17 your area of review and cone of influence? 18 A You would have to change -- recalculate your 19 cone of influence. If it did not exceed 20 two-and-a-half miles, you would not have to change 21 your area of review. 22 Q Gotcha. 23 JUDGE WALSTON: Mr. Williams, I think 24 you said if the pressure is less, I assume meant if 25 the permeability is less --</p>	<p style="text-align: right;">Page 1115</p> <p>1 questions? 2 JUDGE WALSTON: I do. 3 JUDGE EGAN: Okay. 4 CLARIFYING EXAMINATION 5 BY JUDGE WALSTON: 6 Q I just have a couple of questions to make 7 sure I'm clear on one item. As I understand, the cone 8 of influence is the area where the pressure of the 9 injected waste is high enough that it's going to 10 overcome -- I think we talked about a mud plug, 11 correct, in an abandoned well, for example? 12 A In this application, a 421-psi pressure 13 increase within the injection reservoir -- 421 or 14 larger -- was calculated to displace a 15 9-pound-per-gallon mud plug in an old abandoned 16 borehole that had 9-pound-per-gallon mud filling it, 17 minus 50 feet of drawback from the surface. 18 Q Well, and my question to you is: Do you 19 agree that it is a reasonable assumption that one of 20 these abandoned wells is going to have a nine-pound 21 mud plug in it? 22 A Most of the wells that were plugged in -- I 23 believe in the early years of the production of this 24 oil field were probably plugged -- or likely plugged 25 only with mud. And the more recent ones are typically</p>
<p style="text-align: right;">Page 1114</p> <p>1 MR. WILLIAMS: If the permeability -- 2 yes. I'm sorry. Thank you. 3 Q (By Mr. Williams) Have you ever had a well 4 for any of your clients that -- for which you had to 5 address corrective action? 6 A Could you define "corrective action" for me? 7 Q Such as your annual report indicating a 8 larger area -- a larger cone of influence and you 9 would have to go in and plug abandoned boreholes? 10 A No. In the annual report typically one does 11 not recalculate the cone of influence but provides 12 only the results of the Fall-off testing. If it's 13 included with the annual report was included with 14 the mechanical integrity test and report, either way 15 you would present the results of your Fall-off testing 16 in a permeability value. 17 But you would not necessarily, unless 18 the TCEQ reviewer required it, go in and recalculate a 19 cone of influence. That is, at least in my 20 experience, primarily limited to the permitting or 21 permit renewal process -- or the permit amendment 22 process. 23 MR. WILLIAMS: I have no other 24 questions, Your Honor. Pass the witness. 25 JUDGE EGAN: Okay. Do you have any</p>	<p style="text-align: right;">Page 1116</p> <p>1 plugged with mud as well as cement plugs at various 2 depths within the wellbore. 3 Q Right. So that's a conservative assumption? 4 A Yes, nine-pound-per-gallon mud in it filling 5 a borehole without any other plugs of any sort is a 6 conservative assumption. 7 Q And I guess my point is for the Judges, 8 realistically we don't need to worry about some open 9 borehole without any mud or any kind of plug in it? 10 A Well, as the TCEQ assumes the most 11 conservative case is a -- sans any additional records 12 to the contrary -- assumes that a borehole of which 13 there is limited or no plugging information is assumed 14 to have that conservative situation of a 15 nine-pound-per-gallon -- 16 Q That's part of the rules? 17 A That is part of the guidance document for the 18 permit application as presented by the TCEQ. That 19 does not mean that there is a borehole out there that 20 might be just filled with brine or walked away from 21 and a fence post thrown into it. But the default, 22 worst-case scenario is -- as allowed by the TCEQ 23 guidance document is nine-pound-per-gallon mud in the 24 borehole. 25 JUDGE WALSTON: Thank you.</p>

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<p style="text-align: right;">Page 1117</p> <p>1 JUDGE EGAN: Anything else?</p> <p>2 JUDGE WALSTON: No.</p> <p>3 JUDGE EGAN: Mr. Hill, any redirect?</p> <p>4 MR. HILL: I do have some redirect, Your</p> <p>5 Honor.</p> <p>6 REDIRECT EXAMINATION</p> <p>7 BY MR. HILL:</p> <p>8 Q Mr. Grant, could you explain what a well</p> <p>9 conversion is?</p> <p>10 A A well conversion from -- there's many kinds</p> <p>11 of well conversions -- conversion from a oil well to a</p> <p>12 gas well to -- from a gas well to an oil well, from</p> <p>13 either one of either of those to a salt water disposal</p> <p>14 well. There's even the possibility of conversion of</p> <p>15 an oil and gas well or a dry hole which has casing in</p> <p>16 it to a Class I injection well, although that is</p> <p>17 fairly uncommon.</p> <p>18 Q Do you know if what TexCom proposes to do</p> <p>19 with WDW-315 would be considered to be a conversion</p> <p>20 under your understanding of what that term means?</p> <p>21 A No, I think it would be essentially a Class I</p> <p>22 well drilled and abandoned that another operator</p> <p>23 wishes to take as a -- to permit as a new Class I</p> <p>24 injection well.</p> <p>25 Q The point of my question was whether or not</p>	<p style="text-align: right;">Page 1119</p> <p>1 meet Class I permitting standards.</p> <p>2 Q Are you familiar with the term "workover"?</p> <p>3 A Yes, I am.</p> <p>4 Q Can you explain what that means?</p> <p>5 A A workover of a well can be due to several</p> <p>6 reasons. You can lose mechanical integrity of the</p> <p>7 well due to either a casing or tubing leak. Or you</p> <p>8 could -- and that would be -- then you would have to</p> <p>9 take the well apart, meaning take the tubing and/or</p> <p>10 packer potentially out and either put in new tubing or</p> <p>11 pack or maybe put in a casing patch, and then put the</p> <p>12 well back together.</p> <p>13 Or an additional type of workover might</p> <p>14 be to clean out sand in the bottom of the borehole to</p> <p>15 open and cover up perforations. There's many kinds of</p> <p>16 workovers, many kinds of remediations of wells for</p> <p>17 various and sundry reasons that occur.</p> <p>18 Q What about adding perforations to an existing</p> <p>19 well?</p> <p>20 A Typically adding perforations to an existing</p> <p>21 well would be considered a workover and a workover</p> <p>22 report would have to be filed.</p> <p>23 Q Okay. And can you explain what a workover</p> <p>24 report consists of, based on your experience?</p> <p>25 A Based on my experience, a daily chronology of</p>
<p style="text-align: right;">Page 1118</p> <p>1 you believe that whatever rules might exist in TCEQ</p> <p>2 rules that deal with well conversions, whether or not</p> <p>3 based on your professional experience you would expect</p> <p>4 those rules to apply to this well in this set of</p> <p>5 circumstances?</p> <p>6 A Any well, whether it was drilled as a Class I</p> <p>7 or some other format, would have to meet Class I</p> <p>8 construction and permitting standards prior to</p> <p>9 issuance of the permit and/or beginning of operations.</p> <p>10 Q So you don't believe that the conversion</p> <p>11 rules would apply to this well in this case?</p> <p>12 A I'm not sure what you're talking about when</p> <p>13 you say conversion rules.</p> <p>14 Q Well, to be honest with you, in all candor,</p> <p>15 I'm not sure what I'm talking about either, but I know</p> <p>16 Mr. Williams had mentioned the issue of conversion and</p> <p>17 I was curious to know if you thought that this well</p> <p>18 might potentially qualify as a well conversion under</p> <p>19 TCEQ rules?</p> <p>20 A I believe what -- and I can't speak for</p> <p>21 Mr. Williams, but I believe when he's talking about</p> <p>22 conversion, he's talking about a conversion of some</p> <p>23 other well type to a Class I injection well, and that</p> <p>24 would be a generic term of conversion. However, that</p> <p>25 conversion of the well would require that that well</p>	<p style="text-align: right;">Page 1120</p> <p>1 the actions performed on that well would be provided</p> <p>2 in a report, as well as a summary of the additional</p> <p>3 perforations and those depths of those additional</p> <p>4 perforations and what potential stimulation of those</p> <p>5 perforations might occur, and also a discussion of</p> <p>6 the -- if the tubing or -- if the tubing is removed to</p> <p>7 do that, the results of mechanical integrity testing</p> <p>8 after the well is put back together again would be</p> <p>9 included in that workover report.</p> <p>10 Q What about an injection Fall-off test?</p> <p>11 JUDGE EGAN: I'm sorry, I couldn't hear</p> <p>12 you.</p> <p>13 MR. HILL: I apologize, Your Honor.</p> <p>14 Q (By Mr. Hill) What about an injection</p> <p>15 Fall-off test? Is that typically part of a workover</p> <p>16 report?</p> <p>17 A To the best of my knowledge it is not</p> <p>18 typically required for a reperforating of an injection</p> <p>19 well. Operators might do it, but it's not a</p> <p>20 requirement that a Fall-off test be performed.</p> <p>21 Q Do you have access to Volume 10 of the TexCom</p> <p>22 exhibits submitted as part of the prefiled testimony?</p> <p>23 Specifically I'm referring to Exhibit 21, which, if I</p> <p>24 understand, this particular exhibit correctly, it is</p> <p>25 part of a response by TexCom for one of the -- one of</p>

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<p style="text-align: right;">Page 1121</p> <p>1 the NODs submitted by TCEQ. But my question, though, 2 is specifically related to Exhibit 21, Page 21 of 47, 3 if I could draw your attention to that page. 4 A I have it. 5 Q If you would draw your attention to the first 6 paragraph on the page, under that -- under the Table 7 6-7. And specifically I'm looking at the 8 second-to-the-last-sentence of the paragraph. Let me 9 read that to you and make sure that -- let me know if 10 I don't read it correctly. "Once TGD," which I 11 believe is an abbreviation for TexCom Gulf Disposal, 12 "receives their permit for operation, the well will be 13 reperforated in more favorable portions of the 14 injection zone as described in Section 6-A.12." 15 Is there any indication in that 16 statement whether or not -- particularly when TexCom 17 proposes to conduct the additional perforations that 18 they propose as part of their application for WDW-410? 19 A No, it is stated that the well will be 20 reperforated, but it is not stated as to when. 21 Q So do you understand in reading this 22 sentence -- certainly I don't intend to put any words 23 in your mouth -- that TexCom proposes to add 24 perforations after they receive their permit, but is 25 there any particular indication there in whether or</p>	<p style="text-align: right;">Page 1123</p> <p>1 and your understanding of how the UIC program 2 operates, is there any -- do you have any 3 understanding at all whether or not even if a Fall-off 4 test was conducted, say, voluntarily by TexCom, that 5 TCEQ would be required to review that Fall-off test as 6 though it were part of a completion report -- meaning 7 that the cone of influence that was calculated by 8 TexCom as part of their application would be subject 9 to scrutiny and potential amendment by TCEQ based on 10 the results of that Fall-off test? 11 A As best I can tell, there's no requirement in 12 the permit at this point to that effect. 13 Q Let me ask you, if you wouldn't mind, to take 14 a couple of minutes with me to help maybe explain a 15 little bit about what's going on with TexCom's 16 proposal with respect to the lower Cockfield 17 specifically, I'd like to have your help in describing 18 the difference between the current perforated interval 19 of WDW-315 and the proposed injection interval that 20 TexCom describes in their application. Can you 21 define, in terms of depths the current proposed 22 injection interval that TexCom proposes to inject into 23 as part of their application? 24 A I can. I'll have to look in -- to get the 25 exact depths I'll have to look in some of their</p>
<p style="text-align: right;">Page 1122</p> <p>1 not they commit to complete those perforations before 2 the well is actually put into production or before the 3 well becomes operational? 4 A There is no indication of the time frame that 5 that will occur. 6 Q So when the applicant asks whether or not the 7 application is boot-strapped, so to speak, into the 8 terms of the draft permit itself, and I by no means 9 intend to suggest that this particular sentence 10 reflects TexCom's entire position -- there may be a 11 more detailed presentation of their plans in this 12 application that I haven't found. 13 But based on your reading of this 14 particular indication of their proposal, is there 15 anything that leads you to believe that TexCom would 16 be required, if the draft permits were issued as they 17 are proposed today for WDW 410, that they would be 18 required to conduct -- or rather that they would be 19 required to add additional perforations into the sands 20 that they considered to be more favorable and that 21 they be required to do that before operation and to 22 conduct Fall-off tests before operation? 23 A No, not that they would have to perforate 24 immediately. 25 Q And based on your understanding of TCEQ rules</p>	<p style="text-align: right;">Page 1124</p> <p>1 documents to do that. 2 Q Okay. Do you have the documents in front of 3 you? Or if I were to give you the depths would you be 4 able to discern whether or not those are accurate? 5 A If -- 6 Q Let me ask you -- 7 A I can find the document. 8 Q Is it your understanding that the top of the 9 proposed injection interval of TexCom is -- begins at 10 the depth of 6,045 feet? 11 A I believe that is correct. 12 Q And is it your understanding that the bottom 13 of the proposed injection interval of TexCom 14 terminates at a depth of 6,390 feet? 15 A That is correct. 16 Q And just to make sure we can correlate all 17 our data, is that also your understanding of the depth 18 of the lower Cockfield formation at WDW-315? 19 A Yes. 20 Q Okay. So within that depth of 6,045 feet 21 down to 6,390 feet, do you recall whether or not 22 WDW-315 is perforated or -- we know it's perforated 23 within that zone. Do you recall the zone that it is 24 perforated in within those depths? 25 A I would have to look that up. It's in this</p>

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<p style="text-align: right;">Page 1125</p> <p>1 document here.</p> <p>2 Q Do you have that data available to you?</p> <p>3 A Not immediately. I'll have to look for it.</p> <p>4 Q Let's see if I can speed this along and ask</p> <p>5 if I were to tell you that the current perforated</p> <p>6 interval begins at a depth of 6,184 feet, does that</p> <p>7 sound accurate to you?</p> <p>8 A I believe that is the correct number.</p> <p>9 MR. RILEY: You know, Judge, I don't</p> <p>10 mind a little leading, and I certainly don't object to</p> <p>11 speeding things along. But essentially Mr. Hill is</p> <p>12 testifying for the witness, not asking questions and</p> <p>13 getting answers.</p> <p>14 JUDGE EGAN: If you believe the figures</p> <p>15 are incorrect, make your objection. But at this</p> <p>16 point, I think it's beneficial to speed things along.</p> <p>17 MR. RILEY: I understand.</p> <p>18 MR. HILL: Obviously, Your Honor and</p> <p>19 Mr. Riley, I fully expect that Mr. Grant's testimony</p> <p>20 will be subject to cross-examination as appropriate.</p> <p>21 MR. RILEY: Well, it would just be</p> <p>22 helpful for it to be his testimony unless you want to</p> <p>23 take the stand, but --</p> <p>24 JUDGE EGAN: I think that he made it</p> <p>25 real clear that he'd have to look it up and Mr. Hill</p>	<p style="text-align: right;">Page 1127</p> <p>1 that the previous operator-owner of the well decided</p> <p>2 to perforate into. Is that correct?</p> <p>3 A That is correct, of the overall perforated</p> <p>4 interval. And I believe as stated in the application,</p> <p>5 100 feet of net sand were perforated.</p> <p>6 Q Okay. And can you explain your understanding</p> <p>7 of what TexCom proposes to do with WDW -- what would</p> <p>8 be WDW-410 with respect to the perforated interval?</p> <p>9 A In the application TexCom indicates that they</p> <p>10 intend to perforate an additional 45 feet of sand --</p> <p>11 net sand within the lower Cockfield injection</p> <p>12 interval, and to reperforate some of their currently</p> <p>13 perforated interval to bring the total net perforated</p> <p>14 interval up to a maximum for the net available sand</p> <p>15 with that -- within that interval and bring it up to</p> <p>16 145 feet.</p> <p>17 Q So if I understand your testimony correctly,</p> <p>18 the proposal would be to -- well, let me ask you --</p> <p>19 would the proposal be to abandon the current 100 feet</p> <p>20 of perforated interval and find 145 feet of sand</p> <p>21 somewhere else? Or would the proposal be to</p> <p>22 incorporate that current 100 feet of sands, along with</p> <p>23 45 feet of additional sands in the lower Cockfield?</p> <p>24 A It would be to add an additional 45 feet of</p> <p>25 sand perforated and to reperforate some of the -- or</p>
<p style="text-align: right;">Page 1126</p> <p>1 is trying to refresh his memory as to whether or not</p> <p>2 those numbers are correct. If you believe they're</p> <p>3 incorrect, let me know. But otherwise, we're getting</p> <p>4 close to the end of the day and if we can finish with</p> <p>5 this witness it would be beneficial.</p> <p>6 MR. RILEY: I'm fully on board with</p> <p>7 that.</p> <p>8 Q (By Mr. Hill) If I were to tell you that the</p> <p>9 perforation of the current -- or the current</p> <p>10 perforated interval terminates at a depth of 6,372</p> <p>11 feet, does that sound correct to you?</p> <p>12 A Yes, it does.</p> <p>13 Q And do you remember in your review of the</p> <p>14 TexCom application, within that 188 feet of current</p> <p>15 perforated interval, the total extent of sands that</p> <p>16 are perforated into WDW-315?</p> <p>17 A I believe the application states that</p> <p>18 100 feet of sand -- of the sand reservoir are</p> <p>19 perforated -- of net sand reservoir.</p> <p>20 JUDGE EGAN: I'm sorry, what was it?</p> <p>21 WITNESS GRANT: Of the net sand</p> <p>22 reservoir.</p> <p>23 Q (By Mr. Hill) So that means out of the</p> <p>24 188 feet of perforated interval, there's only</p> <p>25 available 100 feet of sands to be perforated into, or</p>	<p style="text-align: right;">Page 1128</p> <p>1 possibly all of the 100 feet that is -- of net sand</p> <p>2 that is currently perforated.</p> <p>3 Q And as we've discussed -- and sounds like</p> <p>4 fully fleshed out -- a follow-up test has already been</p> <p>5 conducted on that 100 feet of perforated sand. Is</p> <p>6 that correct?</p> <p>7 A As presented in the original 315 completion</p> <p>8 report and as noted in the TexCom application. That</p> <p>9 is correct.</p> <p>10 Q And what was -- and what did the results of</p> <p>11 that injection Fall-off test tell us with respect to</p> <p>12 the permeability of those 100 feet of sands that are</p> <p>13 currently perforated in WDW-315?</p> <p>14 A It indicated that the net average</p> <p>15 permeability of that hundred feet of perforated sand</p> <p>16 is 81 millidarcies.</p> <p>17 Q You speak to average. Can you explain a</p> <p>18 little bit about that -- your use of that qualifier?</p> <p>19 A The Fall-off test analyzes the entire section</p> <p>20 or perforated interval of the reservoir that is open</p> <p>21 to receive flow during that test. And so, therefore,</p> <p>22 the results of the Fall-off test are an average for</p> <p>23 that entire hundred feet.</p> <p>24 JUDGE EGAN: I may be confused. Wasn't</p> <p>25 the perforation greater than 100 feet? The hundred</p>

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<p style="text-align: right;">Page 1129</p> <p>1 feet was just of the sand?</p> <p>2 WITNESS GRANT: No, an overall</p> <p>3 perforated interval is noted of about -- from a top to</p> <p>4 a bottom of 188 feet. However, best as I can tell</p> <p>5 from the records, that was -- 188 feet was selectively</p> <p>6 perforated at various depths across the sands present</p> <p>7 in that 188 feet. And so a --</p> <p>8 JUDGE EGAN: Okay.</p> <p>9 WITNESS GRANT: -- net perforated</p> <p>10 interval was 100 feet, not 188 feet.</p> <p>11 JUDGE EGAN: I understand. Thank you.</p> <p>12 JUDGE WALSTON: Mr. Hill, just so I'm</p> <p>13 clear and the record is clear, when you started this</p> <p>14 line of questioning -- maybe I'm hearing things -- I</p> <p>15 wrote down WDW-410, but this has all been related to</p> <p>16 the existing well, WDW-315.</p> <p>17 MR. HILL: I apologize for the</p> <p>18 confusion, Your Honor. If I understand the</p> <p>19 application correctly, the existing well as it exists</p> <p>20 today at one time was permitted by TCEQ as WDW-315.</p> <p>21 That particular well, if these draft permits are</p> <p>22 issued, will be recognized by TCEQ as WDW-410.</p> <p>23 JUDGE WALSTON: Okay.</p> <p>24 MR. HILL: So there is an interchange</p> <p>25 there, and I apologize for the confusion.</p>	<p style="text-align: right;">Page 1131</p> <p>1 provide an average for the entire interval of 500</p> <p>2 millidarcies.</p> <p>3 Q Now, we do have some data on the permeability</p> <p>4 of at least portions of the strata that's not yet</p> <p>5 perforated into but is part of the lower Cockfield, do</p> <p>6 we not?</p> <p>7 A Yes, we have a 14-foot core that was taken</p> <p>8 during the drilling of 315 through one sand in the</p> <p>9 upper portion of the lower Cockfield, which is</p> <p>10 above -- about 100 feet above the currently-perforated</p> <p>11 interval.</p> <p>12 Q And if you recall, was a test conducted to</p> <p>13 determine the potential or the permeability of those</p> <p>14 sands that were bored?</p> <p>15 A Plugs out of that 14 feet of core probably</p> <p>16 on -- 2-inch plugs were drilled out of -- five 2-inch</p> <p>17 plugs were drilled out of that 14 feet and submitted</p> <p>18 to a petrophysical laboratory for analysis of</p> <p>19 permeability and porosity, and the results of those</p> <p>20 analyses are included in the completion report for</p> <p>21 315.</p> <p>22 Q Do you recall what the results of those tests</p> <p>23 suggested?</p> <p>24 A They provided a range of permeabilities of</p> <p>25 over 800 millidarcies to approximately 6 millidarcies</p>
<p style="text-align: right;">Page 1130</p> <p>1 JUDGE WALSTON: Okay.</p> <p>2 Q (By Mr. Hill) The applicant has suggested</p> <p>3 that the permeability -- the applicant has suggested</p> <p>4 that they anticipate the average permeability of the</p> <p>5 entire lower Cockfield -- that is all of the 145 feet</p> <p>6 of available sands acceptable to receive injected</p> <p>7 waste is somewhere around -- well, is 500</p> <p>8 millidarcies. Is that correct?</p> <p>9 A Yes.</p> <p>10 Q Can you explain why you believe, based on --</p> <p>11 let me take a step back. You put a lot of importance</p> <p>12 on the data from the current 100 feet of perforated</p> <p>13 sands, do you not?</p> <p>14 A Yes, I believe it is representative of the</p> <p>15 perforated reservoir at this time.</p> <p>16 Q Okay. How -- can you explain then, based on</p> <p>17 that information, why you believe 500 millidarcies is</p> <p>18 an unrealistic expectation of what that -- the</p> <p>19 permeability of those 145 feet of sands would likely</p> <p>20 be?</p> <p>21 A Well, to get -- to add an additional 45 feet</p> <p>22 of perforation of sand to get a maximum reservoir</p> <p>23 thickness in the injection interval of 145 feet, one</p> <p>24 would have to have a permeability of the remaining</p> <p>25 45 feet exceed something like 1400 millidarcies to</p>	<p style="text-align: right;">Page 1132</p> <p>1 with, I think, an average of those five cores of</p> <p>2 approximately 390 millidarcies as stated in the core</p> <p>3 analysis report.</p> <p>4 Q Do you have Volume 9 of the TexCom prefiled</p> <p>5 testimony available to you?</p> <p>6 A Yes, I do.</p> <p>7 Q Would you turn your attention to TexCom</p> <p>8 Exhibit 11, specifically Page 146 of 270?</p> <p>9 MR. RILEY: I'm sorry, what page</p> <p>10 counsel?</p> <p>11 MR. HILL: 146 of 270.</p> <p>12 A Yes, I have it.</p> <p>13 Q Could you explain what -- what the data on</p> <p>14 this page --</p> <p>15 JUDGE WALSTON: Give us second --</p> <p>16 MR. HILL: Sorry.</p> <p>17 JUDGE EGAN: Exhibit 11?</p> <p>18 JUDGE WALSTON: Go ahead.</p> <p>19 Q (By Mr. Hill) When you were referring to the</p> <p>20 ranges of the core samples taken, is this the</p> <p>21 information you were referring to?</p> <p>22 A Yes, it was.</p> <p>23 Q Could you specifically point us -- there's</p> <p>24 several columns of information here. Could you point</p> <p>25 is to the columns that you're referring to?</p>

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<p style="text-align: right;">Page 1133</p> <p>1 A There are two subcolumns under the 2 permeability millidarcies column. And there are five 3 sample depths to the left of that showing the depths 4 at which the core plugs were taken and the results of 5 permeability analyses. 6 The permeability is typically -- in this 7 form of analysis -- run using air to flow through the 8 core and then a correction factor for liquid, which is 9 a Klinkenberg correction factor is applied to those 10 results, which typically is more reflective of the 11 conditions of the rock when fluid is -- as you would 12 have in a natural subsurface environment. And those 13 permeabilities for those five depths are noted on the 14 Klinkenberg 2000 psi column. 15 Q Based on this particular set of data and 16 based on your understanding of the sand and shale 17 composition of the lower Cockfield and based on your 18 understanding of the results of the Fall-off testing 19 that was taken on WDW-315, do you have any reason to 20 believe that the 45 feet of remaining sands in the 21 lower Cockfield will have a permeability in excess of 22 1400 millidarcies once tested? 23 A It's unlikely in that the results of this 24 core analysis do not provide any analysis showing that 25 high a permeability value.</p>	<p style="text-align: right;">Page 1135</p> <p>1 pressure increase of 421 psi of approximately, I 2 believe, 3170-a-foot radius from the injection well 3 from 315. 4 The second one -- in which case the 5 fault to the south is considered a no-flow boundary -- 6 has a -- has a radius of the cone of influence 7 directly to the north of something like 2.7 miles. 8 Q Well, let's -- do you have your prefiled 9 testimony in front of you? 10 A I do. 11 Q Can you flip expediently to the pressure 12 models that you conducted and let us know where you're 13 looking with respect to prefiled testimony? 14 A In my prefiled testimony, Exhibits 12 and 13 15 have my two scenarios of pressure modeling. And 12 is 16 a laterally-transmissive fault in which the cone of 17 influence is -- all the way to the bottom of the table 18 there -- it has a distance of 3170 feet from the 19 injection well. 20 Q Okay. 21 A The second scenario in which the fault is 22 considered a no-flow boundary has a cone of influence 23 directly to the north of approximately 14,300 feet 24 from the injection well. This cone of influence would 25 necessarily be expanded a greater distance as one</p>
<p style="text-align: right;">Page 1134</p> <p>1 Q So I'll ask: Is it possible that those sands 2 could be very clean sands, it could have a very high 3 permeability, so that the average permeability of the 4 entire injection interval would be 500 millidarcies? 5 A It is possible, but based upon the data here 6 it's extremely unlikely. 7 Q Okay. Now, of course, the bottom line is -- 8 is whether or not the 500-millidarcy assumption used 9 by the applicant in their pressure modeling in their 10 application is a -- a figure that is sufficiently 11 conservative to be adequately protective of human 12 health and the environment, and my question is do you 13 believe that the 500-millidarcy figure is that 14 conservative figure? 15 A No, I do not. 16 Q Okay. Let me take a step back. You ran two 17 models on your own as part of your review of this 18 application. Isn't that correct? 19 A That is correct. 20 Q Can you explain -- without going into a 21 tremendous amount of detail -- can you explain the 22 differences in the cones of influence, with respect to 23 each model, meaning differences in feet from wellbore? 24 A The first -- or one of the models has a 25 resultant cone of influence which is defined by a</p>	<p style="text-align: right;">Page 1136</p> <p>1 moved laterally along the fault due to the fact that 2 there would be no pressure dissipation south of the 3 fault. 4 So although I did not calculate it, it 5 would have a -- kind of a squashed moon shape and 6 would be further out to the west and east along the 7 fault line. 8 Q Based on -- and let's make the record 9 clear -- the input values you used for these models 10 were what with respect to permeability and thickness? 11 A I was trying to match the BOAST model as best 12 I could and using only the difference of permeability 13 as compared to the applicant's model, and issues of 14 transmissivity or pressure boundary of the fault to 15 the south -- the fault to the south acting as a 16 no-flow boundary. 17 Q For the purposes of modeling in a Class I UIC 18 application, based on your experience with putting 19 these applications together, which do you believe, 20 based on all the data that you have available to you 21 in this application, to be the more conservative value 22 with respect to the anticipated permeability of the 23 injection reservoir proposed by TexCom, 500 24 millidarcies or 81 millidarcies? 25 A I believe 81 millidarcies is a more</p>

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<p style="text-align: right;">Page 1137</p> <p>1 conservative value.</p> <p>2 Q And for purposes of that same modeling for</p> <p>3 the same type of application, which do you believe to</p> <p>4 be a more conservative value with respect to modeling,</p> <p>5 a -- considering the fault 4400 feet to the south of</p> <p>6 315 to be laterally transmissive or laterally sealing?</p> <p>7 A Laterally sealing.</p> <p>8 Q Let me ask you again, Mr. Grant, whether or</p> <p>9 not you believe, if these draft permits were issued</p> <p>10 today, that TexCom would be required to conduct any of</p> <p>11 the perforations -- and certainly whether or not they</p> <p>12 would be required to subject any of that additional</p> <p>13 work to Fall-off testing -- and have all that work be</p> <p>14 subject to scrutiny of TCEQ before that well WDW-410</p> <p>15 could be put into operation?</p> <p>16 A No, I do not believe that those safeguards</p> <p>17 are in place as the permit is currently written -- as</p> <p>18 this draft permit is currently written.</p> <p>19 MR. HILL: One second, Your Honor.</p> <p>20 Q One last question, Mr. Grant. Can you please</p> <p>21 explain, in as simple terms as you can come up with,</p> <p>22 what type of Fall-off test would be required to allow</p> <p>23 us to know, with some degree of reliability, whether</p> <p>24 or not the fault to the south is laterally sealing?</p> <p>25 A A Fall-off test under the either current or</p>	<p style="text-align: right;">Page 1139</p> <p>1 completion report?</p> <p>2 A Typically there is no preset distance that --</p> <p>3 for a radius of investigation that one would have to</p> <p>4 run the Fall-off test for. So typically a Fall-off</p> <p>5 test would be run long enough until you got into a</p> <p>6 radial flow period and then the Fall-off test ended</p> <p>7 once you're in a radial flow period. This kind of a</p> <p>8 test would be extended out a time frame to necessarily</p> <p>9 reach a radius of investigation past the distance of</p> <p>10 the fault to the south.</p> <p>11 MR. HILL: I have no further questions,</p> <p>12 Your Honor.</p> <p>13 JUDGE EGAN: Okay. Mr. Walker?</p> <p>14 MR. WALKER: No questions, Your Honor.</p> <p>15 JUDGE EGAN: Mr. Forsberg?</p> <p>16 MR. FORSBERG: I have no questions, Your</p> <p>17 Honor.</p> <p>18 JUDGE EGAN: Ms. Collins?</p> <p>19 MS. COLLINS: No questions.</p> <p>20 JUDGE EGAN: Mr. Riley?</p> <p>21 MR. RILEY: Just a few, and I'll try to</p> <p>22 be very quick.</p> <p>23 JUDGE EGAN: That's okay.</p> <p>24</p> <p>25</p>
<p style="text-align: right;">Page 1138</p> <p>1 additional perforated conditions should be run long</p> <p>2 enough so that any pressure boundary or no-flow</p> <p>3 boundary located to the south at the fault some</p> <p>4 4400 feet away would show up in the data -- in the</p> <p>5 analysis of that data. And that can be calculated</p> <p>6 while -- prior to the test based upon an estimated</p> <p>7 permeability.</p> <p>8 And it can be confirmed during the test</p> <p>9 before the test is over by doing analyses of the data</p> <p>10 as gathered to that point and looking for indications</p> <p>11 of boundaries or not. And determinations can be run</p> <p>12 as the Fall-off test is in progress from the data as</p> <p>13 gathered what your radius of investigation is. And a</p> <p>14 radius of investigation for the Fall-off test should</p> <p>15 extend beyond 4400 feet, not just to it, but some</p> <p>16 distance beyond it to confirm or disprove whether a</p> <p>17 no-flow boundary or some other kind of a barrier is</p> <p>18 present for that location.</p> <p>19 Q And just as a quick follow-up, how much of</p> <p>20 more of an undertaking would that test be -- that</p> <p>21 particular breadth of a Fall-off test be -- how much</p> <p>22 more of an undertaking would that be over and above</p> <p>23 what you would normally be required to do under TCEQ</p> <p>24 rules as if this were a brand new well and you were</p> <p>25 constructing a Fall-off test for the purposes of a</p>	<p style="text-align: right;">Page 1140</p> <p>1 RE CROSS-EXAMINATION</p> <p>2 BY MR. RILEY:</p> <p>3 Q Mr. Grant, did anything that Mr. Hill asked</p> <p>4 you about change your opinion that with a Fall-off</p> <p>5 test demonstrating an average permeability of 500</p> <p>6 millidarcies and a radius of investigation out beyond</p> <p>7 the fault would relieve your concerns regarding the</p> <p>8 review of this application?</p> <p>9 A If those things -- what were the two things</p> <p>10 again?</p> <p>11 Q Reperforation of the well, which we've been</p> <p>12 referring to interchangeably as WDW-315 and WDW-410,</p> <p>13 those are the same well, correct?</p> <p>14 A Yes, that is correct.</p> <p>15 Q So if that was reperforated as proposed in</p> <p>16 the TexCom application, and a Fall-off test was done</p> <p>17 that had a radius of investigation out beyond the</p> <p>18 fault to the southeast, the 4400-foot away fault --</p> <p>19 say the radius of investigation went out 4600 feet,</p> <p>20 would it relieve any concern you have if it proved two</p> <p>21 things -- one, that the permeability was greater than</p> <p>22 500 millidarcies and, two, that there was no boundary</p> <p>23 determined by the Fall-off test at 4400 feet?</p> <p>24 A Yes, that would alleviate many of my</p> <p>25 concerns. What I would -- I would think would be</p>

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<p style="text-align: right;">Page 1141</p> <p>1 appropriate would be not -- since we don't the exact 2 location of fault -- would not necessarily to take it 3 an additional 200 feet past but, say, potentially a 4 thousand feet past 4400 feet. And that would entail 5 just running the fault injection period of the test in 6 the Fall-off period longer. 7 Q And those -- that is achievable with the 8 Fall-off test? In other words, that distance is 9 something that can commonly -- or is commonly 10 investigated by a Fall-off test. Is that correct? 11 A Yes, there's -- there are numerous Fall-off 12 tests, depending upon the permeability, of course, and 13 the thickness to where you would get distances out 8, 14 10,000 feet of investigation depending upon the length 15 of the test. 16 Q All right. Let's go back just quickly now to 17 the terminology used in redirect examination. There's 18 something called the injection zone, correct? And 19 that is the full interval as described in the TexCom 20 application for the lower Cockfield, correct? 21 A No, the injection zone is the upper, middle 22 and lower Cockfield. 23 Q Okay. But in terms of the sand, you're 24 correct. I'm sorry. In terms of the sand that we're 25 talking about, we're talking about the lower Cockfield</p>	<p style="text-align: right;">Page 1143</p> <p>1 perforated in that 188 feet interval. 2 Q Okay. So if I took -- again just for 3 purposes of clarity -- 188 feet and the first 2 feet I 4 perforate, that's 2, correct? 5 A Yeah, if it's in -- if we're counting towards 6 the 100 feet, it would have to be 2 feet in a sand. 7 Q That's right. So I perforate 2 feet in a 8 sand, then go down -- in other words, it's a 9 cumulative total, and it totals to a net of 100 feet. 10 A Yes. And I don't know from the records 11 whether it was -- I believe it was selective 12 perforations across sands to come up with 100 feet. I 13 don't believe the entire 188 feet, which includes many 14 shales, was entirely -- that interval was perforated. 15 Q Okay. Is there a -- and I'm going to use 16 terms that I only basically understand. Is there a 17 number of shots-per-foot that is standard in the 18 industry for a perforation? 19 A I'm not a petroleum engineer, but to my 20 experience it is typically somewhere between 2 to 4 21 shots per foot, depending upon your perforating guns. 22 Q Okay. If the current well were perforated at 23 2 shots-per-foot and the intention is to perforate it 24 at 4 slots per foot, would you agree that that could 25 increase the permeability in the well, assuming</p>
<p style="text-align: right;">Page 1142</p> <p>1 and its thickness in the area of WDW -- I'll use 2 310 -- 3 A 315. 4 Q -- 315. I'm sorry. 315. It's approximately 5 345 feet. Is that correct? 6 A The gross thickness of the injection interval 7 is approximately that, correct. 8 Q Now, when we talk about an injection interval 9 and Mr. Hill asked you some questions about the 10 hundred foot of sand that is currently perforated, 11 we're talking about some portion of that hundred 12 feet -- excuse me, of that 345 feet -- 13 A That is correct. 14 Q And you indicated that's about 188 feet of 15 that 345 feet, but it is netted for the actual -- for 16 the actual perforation. In other words, within that 17 188 feet the current well is perforated in 18 approximately 100 feet? 19 A It's perforated in approximately 100 feet of 20 sand. 21 Q I'm sorry. Just to be clear -- I don't mean 22 to cut you off. I apologize. 23 A I suppose there might be some perforations in 24 shales. But as defined -- or as presented in the 25 TexCom application, 100 feet of sand have been</p>	<p style="text-align: right;">Page 1144</p> <p>1 nothing else? 2 A No -- are you talking about re-perforating a 3 specific sand and then changing the permeability of 4 that specific sand that's already been perforated? 5 Q I'm saying that within the foot -- interval 6 of a foot it seems like there's a number of shots that 7 are currently perforated. In other words, there are 2 8 shots-per-foot, I'm led to believe. 9 A I don't have a confirmation of that, but if 10 you're saying it's 2 shots-per-foot, I'll assume 11 that's the case. 12 Q Okay. And if it's increased to 4 13 shots-per-foot, would that change the results of a -- 14 that fact alone, nothing else -- change the results of 15 the Fall-off test? Do you know? 16 A I do not believe so. It will open more of 17 that 1 foot of sand -- more holes into it and 18 potentially, on a Fall-off test, decrease your skin. 19 But there's no direct correlation to increasing your 20 permeability since you're still looking at the same 1 21 foot sand whether it has 2 shots-per-foot in it or 4 22 shots-per-foot put in it. 23 Q Okay. 24 A Skin being, you know, friction pressure loss 25 due to a fluid movement out of those perforations into</p>

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<p style="text-align: right;">Page 1145</p> <p>1 the -- into the formation sand.</p> <p>2 Q Okay. Have you ever done a reperforation of</p> <p>3 a well increasing the number of shots-per-foot?</p> <p>4 A My company has. I specifically do not go out</p> <p>5 on the well and do reperforations. But I have been</p> <p>6 involved in the preparation of reports after that has</p> <p>7 been done.</p> <p>8 Q And in those instances you've not seen any</p> <p>9 difference in terms of permeability calculation?</p> <p>10 A Not that I can recall.</p> <p>11 Q Moving on, is the average permeability a</p> <p>12 function of a numeric average in terms of feet of</p> <p>13 sand? Because I thought when Mr. Hill was asking you</p> <p>14 questions you were correlating simply that hundred</p> <p>15 feet at a permeability of 81 millidarcies, and that if</p> <p>16 you added 45 feet to it, you calculated -- I think it</p> <p>17 was 1400 millidarcies would be necessary in order to</p> <p>18 bring the average up to 500 millidarcies. Is that an</p> <p>19 arithmetic average?</p> <p>20 A It's a weighted arithmetic average. In other</p> <p>21 words, approximately 69 percent, which would be 100</p> <p>22 over 145, has a permeability of 81 millidarcies as</p> <p>23 based upon the Fall-off test. If the remainder- 45</p> <p>24 out of 145 feet, that's approximately 31 percent --</p> <p>25 that is the unknown "X" and those two together, when</p>	<p style="text-align: right;">Page 1147</p> <p>1 JUDGE EGAN: Mr. Riley, I just have a</p> <p>2 quick question. Do you have many more questions?</p> <p>3 Because we have to adjourn at 6:00.</p> <p>4 MR. RILEY: We could break now and just</p> <p>5 pick up here. I probably have 10 more minutes, but</p> <p>6 I'm not --</p> <p>7 WITNESS GRANT: I'd rather finish up, if</p> <p>8 possible.</p> <p>9 JUDGE WALSTON: If we can get it in</p> <p>10 about 10 minutes, but I do need to leave shortly.</p> <p>11 MR. RILEY: I understand.</p> <p>12 JUDGE EGAN: Okay.</p> <p>13 Q (By Mr. Riley) Let me see if I understand.</p> <p>14 Is there any book or paper I could look to to verify</p> <p>15 your method of calculation in a weighted average</p> <p>16 context to understand how you came up with your 1400</p> <p>17 millidarcie calculation?</p> <p>18 A It's just a simple calculation of weighted</p> <p>19 averages, and I believe I have several textbooks that</p> <p>20 present that methodology.</p> <p>21 Q Okay. The methodology, as I understand it,</p> <p>22 is you take the least -- or less permeable sand and</p> <p>23 you say that's 69 percent of the -- of the perforated</p> <p>24 interval, correct?</p> <p>25 A Yeah. Maybe it's simpler to just break it in</p>
<p style="text-align: right;">Page 1146</p> <p>1 you take that weighted average, would have to equal</p> <p>2 500 millidarcies.</p> <p>3 Q But ultimately --</p> <p>4 A So to recalculate back to what your "X" is,</p> <p>5 that weighted average -- or that average for the</p> <p>6 remaining 45 would have to be over 1400 millidarcies</p> <p>7 to make the entire 145 feet have a net permeability of</p> <p>8 500 millidarcies.</p> <p>9 Q Mr. Grant, wouldn't it actually be exactly</p> <p>10 opposite of your calculation? Wouldn't more fluid</p> <p>11 exit out the more permeable sand and, therefore, be</p> <p>12 inverse of what you just calculated?</p> <p>13 A No, I don't believe so. In a Fall-off test,</p> <p>14 if you have the entire 145 feet over the period of the</p> <p>15 time of the Fall-off test, it would be 145 feet all</p> <p>16 take flow. You are getting a permeability value</p> <p>17 that's calculated off of that 145 feet. If only</p> <p>18 20 feet of that take flow, your permeability value is</p> <p>19 going to be calculated off that 20 feet, but your flow</p> <p>20 capacity, which would go into your pressure model</p> <p>21 would have a much lower thickness at that point. It</p> <p>22 would have a higher permeability but a lower thickness</p> <p>23 since they're both in the denominator of the pressure</p> <p>24 increase calculation. It would probably be a wash.</p> <p>25 Q Well, then --</p>	<p style="text-align: right;">Page 1148</p> <p>1 thirds. In other words, you have to say you assume</p> <p>2 150 feet total, and two-thirds of that -- that means</p> <p>3 50 feet and 50 feet have 81 millidarcies, and that</p> <p>4 third third is unknown. But the three of those added</p> <p>5 up together and divided by 3 would need to equal 500</p> <p>6 millidarcies.</p> <p>7 Q Okay. But again, if I'm following along, if</p> <p>8 I had an 800 millidarcy permeability in a sand layer</p> <p>9 that I used -- or wouldn't that be the preferential</p> <p>10 pathway under pressure for fluid? So wouldn't most of</p> <p>11 the fluid in this Fall-off test exit into the more</p> <p>12 permeable sand?</p> <p>13 A Yes, it would. An initial part of the</p> <p>14 Fall-off test, until it starts to build up pressure,</p> <p>15 and then it will start to flow into other sands that</p> <p>16 haven't pressured up or that have slightly lower</p> <p>17 permeability but now are accepting flow.</p> <p>18 So it's hard to make a judgment as to</p> <p>19 that 20-foot or whatever it is with a very high</p> <p>20 permeability taking the flow over the entire injection</p> <p>21 period. It is much more likely that the -- that in a</p> <p>22 virgin reservoir such as this that over the period of</p> <p>23 the Fall-off or the injection period that all the</p> <p>24 sands will take flow and an average will be gathered,</p> <p>25 which relates to the true average of that reservoir in</p>

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<p style="text-align: right;">Page 1149</p> <p>1 the long-term to take fluid.</p> <p>2 Q All right. I understand your position, and</p> <p>3 let me see one more time, just for absolute clarity,</p> <p>4 all of this would be verified by a Fall-off test post</p> <p>5 permit if you had -- if there was a condition that</p> <p>6 required it, correct? And that would answer the</p> <p>7 question, whether it be your method of calculation or</p> <p>8 Mr. Casey's method of calculation, it would be</p> <p>9 addressed in a Fall-off test?</p> <p>10 A You mean calculation related to the</p> <p>11 permeability?</p> <p>12 Q Yes, and as we talked about the radius of</p> <p>13 investigation of the fault to the --</p> <p>14 A And the determination of a no-flow boundary</p> <p>15 to the south, those numbers would essentially be</p> <p>16 determined.</p> <p>17 MR. RILEY: Thank you. No further</p> <p>18 questions.</p> <p>19 JUDGE EGAN: All right. Mr. Williams?</p> <p>20 MR. WILLIAMS: I have three short -- I</p> <p>21 hope -- questions, and if I can get short answers.</p> <p>22 JUDGE EGAN: If you could speak up</p> <p>23 loudly though because we've got sirens going behind</p> <p>24 us.</p> <p>25 MR. WILLIAMS: Right.</p>	<p style="text-align: right;">Page 1151</p> <p>1 approximately?</p> <p>2 A Well, the -- would have to be calculated</p> <p>3 based upon a formula or constant -- or monitoring the</p> <p>4 data as it's gathered during the injection period.</p> <p>5 But there are certain basic formulas you can use using</p> <p>6 worst-case permeabilities as to what the radius of</p> <p>7 influence would be. And so that would have to be</p> <p>8 calculated, but my guess is it would be anywhere from</p> <p>9 24 to potentially 72 hours of injection.</p> <p>10 Q The Fall-off test that was conducted on Well</p> <p>11 315, do you remember how long it was run?</p> <p>12 A I believe it was run for 12 hours at a</p> <p>13 certain rate -- I think 3 barrels-a-minute -- which is</p> <p>14 120-some gallons-per-minute.</p> <p>15 Q And didn't you express some concern -- a</p> <p>16 little bit of concern in your deposition that it was</p> <p>17 possibly not run long enough but it was run long</p> <p>18 enough for you to accept the values. Is that correct?</p> <p>19 A Yes, it was run long enough to get into</p> <p>20 radial flow to determine what the permeability of the</p> <p>21 reservoir within 1500 feet was. I just, as a rule of</p> <p>22 thumb, like to run injection periods on the -- on the</p> <p>23 Fall-off testing a minimum of 24 hours just for my own</p> <p>24 purposes.</p> <p>25 MR. WILLIAMS: No further questions.</p>
<p style="text-align: right;">Page 1150</p> <p>1 RECROSS-EXAMINATION</p> <p>2 BY MR. WILLIAMS:</p> <p>3 Q Mr. Grant, you testified about an instance</p> <p>4 where your client reperforated one of their wells?</p> <p>5 A That is correct.</p> <p>6 Q And there was no significant change in the</p> <p>7 Fall-off test. Is that correct?</p> <p>8 A We're talking about where they reperforated</p> <p>9 the same sands they had already perforated?</p> <p>10 Q Well, that's -- tell me. Why did they</p> <p>11 reperforate?</p> <p>12 A They reperforated to get more holes per foot</p> <p>13 within the sands that they had already perforated.</p> <p>14 And it did not change to any substantial degree --</p> <p>15 meaning within 5 to 10 millidarcies what the resultant</p> <p>16 permeability as calculated was.</p> <p>17 Q Then why did they do it?</p> <p>18 A Because they were having problems with skin</p> <p>19 issues related to the current perforations that they</p> <p>20 had and somewhat plugging of the -- of those</p> <p>21 perforations.</p> <p>22 Q Okay. You mentioned that the -- a test that</p> <p>23 would detect the 4400-foot boundary, whether it would</p> <p>24 be transmissive or no-flow boundary, plus a thousand</p> <p>25 feet beyond it needed to be long enough. How long,</p>	<p style="text-align: right;">Page 1152</p> <p>1 Pass.</p> <p>2 JUDGE EGAN: All right. Any redirect?</p> <p>3 MR. HILL: No further questions, Your</p> <p>4 Honor.</p> <p>5 JUDGE EGAN: All right. You have no</p> <p>6 questions -- then you're excused. Thank you very</p> <p>7 much.</p> <p>8 WITNESS GRANT: Thank you.</p> <p>9 JUDGE EGAN: Tomorrow morning -- I'm</p> <p>10 getting lost on where we're at. Is Lone Star --</p> <p>11 MR. HILL: We have no more witnesses,</p> <p>12 Your Honor.</p> <p>13 JUDGE EGAN: And do you have any more</p> <p>14 witnesses? You're finished, Mr. Walker?</p> <p>15 Mr. Forsberg -- I think we're just down</p> <p>16 to staff. Is that correct?</p> <p>17 MR. FORSBERG: I may have a couple of</p> <p>18 just little clean-up issues, but no witnesses.</p> <p>19 JUDGE EGAN: All right. So we'll begin</p> <p>20 tomorrow morning with the staff's witnesses, other</p> <p>21 than some clean-up right in the beginning.</p> <p>22 MR. RILEY: And I know Judge Walston</p> <p>23 needs to go, but just quickly what I anticipate right</p> <p>24 now is a very brief rebuttal. I would be surprised if</p> <p>25 it lasts more than two or three hours. And that</p>

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1 really largely depends on cross-examination.

2 As we talked about, I will attempt to
3 file the direct of the rebuttal as prefiled rebuttal.

4 I don't have it together now, so I can't offer it
5 probably more than a couple of hours before I actually
6 finish it.

7 JUDGE EGAN: Okay. Then we're adjourned
8 until tomorrow morning at nine o'clock.

9 (Proceedings recessed at 6:01 p.m.)
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